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THE SHRINKAGE IN WEIGHT OF BEEF CATTLE IN TRANSIT.

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I. SOUTHWESTERN SHRINKAGE WORK OF 1910–11.

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INTRODUCTION.

The transfer of cattle from the farm or ranch to the market usually necessitates a drive to the railroad and a further journey on the cars. These drives may vary in distance from a few hundred yards to more than a hundred miles, depending upon the location of the ranch, while the railroad journey may consume any time from a few hours to several days. All cattlemen know that when their stock arrives at market they are usually lighter in weight than when they started. This loss in weight is called shrinkage. The shrinkage in weight of cattle in transit to market is the difference between the weight of the animals at the point of origin and the weight of the animals on arrival at destination. The net shrinkage is the difference in the weight at the point of origin and the weight of the animals when sold at the market.

In shipping all animals there will be some loss in weight during the journey due to excretions from the alimentary canal, from the urinary organs, and from moisture given off by the lungs in breathing. A portion of this loss may be regained at the market by the food and water taken into the system. The consumption of this food and water at the market is termed the "fill." The loss in weight which occurs while the cattle are in the cars between the point of origin and the destination is termed "shrinkage en route" or "shrinkage before fill," and the loss in weight after the animal has had feed, water, and rest is termed the "shrinkage after fill" or the "net shrinkage," or simply as the shrinkage of the animal. In all parts of

this bulletin where shrinkage is mentioned it should be understood that it is the net shrinkage which is referred to. This net shrinkage is the amount of weight lost to the shipper of the cattle, and for this reason is the shrinkage of most interest to the cattleman.

All cattlemen, shippers, and carriers of live stock are cognizant of the fact that, as a rule, there will be some loss in weight of the animals due to shipping, and if the shipping conditions are about the average, the shrinkage should be about the average or normal, and that this normal loss should be borne by the shipper. However, if the service of the carrier is poor because of accidents, delays, rough handling, or willful carelessness, it is natural to suppose that the shrinkage of the animals would be greater, and that this difference between the normal and the excessive loss in weight should be paid for by the carrier and not lost by the shipper.

Each year there are thousands of dollars involved in legal entanglements between shippers and common carriers because of this excessive shrinkage. In the Southwest the usual method of settling these claims is rather crude. It is simply a matter of opinion of those who are supposed to know something from experience about shipping cattle. These opinions are at times very conflicting. In a case in point one witness stated that cattle shipped from a certain point would shrink 90 pounds a head, while a witness on the other side was of opinion that the cattle would not shrink over 30 pounds. There are no scales in any portion of the range country of the Southwest, and all estimates of the weights and shrinkages of the animals were guesses—good ones sometimes, no doubt, but frequently very poor.

This method is an unsatisfactory way of settling claims. A knowledge of the normal shrinkage of animals moving to market will enable the shipper or cattleman to get a more definite idea of the value of his cattle at home from the market reports. If he knows approximately what the freight and other expenses on his cattle will be and also knows about what to expect from shrinkage, he can figure fairly accurately what they will bring on the market, and will be in a position to save many dollars by knowing what to ask local buyers for them. Of course, there is always the possibility of a variation in the shrinkage, a change of market, etc., which entails a little risk in shipping, and it is this risk which enables local buyers or speculators to secure cattle.

OBJECT OF THE INVESTIGATION.

The objects of the work may be briefly stated as follows:

1. To secure weights of enough cattle of each class in order that comparisons could be made of the shrinkage of one class of cattle with another for a given period of time.

2. To determine, if possible, at what period of the journey the greatest shrinkage occurred.

3. To study what effects the different methods of handling the cattle previous to loading them had upon the shrinkage in transit.

4. To note the effect of the weather at time of shipping upon the shrinkage in transit and the fill taken at market.

5. To determine the relative benefit, if any, of a good, quick run to market as compared to a slow, rough trip with careless handling of the train.

6. To see whether or not feeding and watering the cattle a short time before loading them was beneficial.

7. To note the difference in shipping cattle long distances in "feed and water" cars without unloading them, as against the method of unloading in transit to feed, water, and allow the stock to rest.

8. To study the shrinkage of cattle that have been finished for the market upon various feedstuffs.

9. To note what influence the season will exert upon the shrinkage.

10. To obtain reliable data that may be used as a basis upon which the cattleman can calculate the approximate shrinkage in weight of his cattle in shipping.

PLAN OF THE WORK.

This investigation was begun in August, 1910, and was planned to extend into the important parts of the range and feeding sections of the country and to incorporate results for the different classes of cattle when shipped under various conditions. To carry out the investigation the cooperation of both the railroads and the cattlemen had to be obtained. The cooperation of the railroads was necessary, as there were no stock scales on the ranches of the Southwest, so the cattle had to be weighed on the railroad track scales at the point of origin. The cars had to be weighed while empty and again after loading, the difference in the two weights being, of course, the weight of the cattle.

Each car was "cut loose" at each end from the other cars, so that the "pull" on the coupling would not affect the weight of the car. This required quite a little work from the crews of the switch engines, but the help was always courteously given by the railroads without charge. The shipper was asked to sign a printed form giving his consent to have the cattle weighed, so that the railroads could not be held responsible for the little delay caused by weighing the stock. The work was done very fast, requiring about one minute per car, and very little time was lost.

The weights of the animals were taken at the point of loading, on arrival at their destination, and again after having rest, feed, and

water. The last weight was the weight secured when the animals were sold.

The cooperation of the bureau officials at the market was secured, so that the weighing of the cattle on arrival could be done officially when it was impossible for the field man to follow the shipment. This was desired, as such weighing would be more accurate than if left to the railroad or stockyards employees, because the common practice among the railroad men is to record 100 pounds as the smallest break in the scales. For instance, if a loaded car weighed 54,340 pounds, it was written 54,300; if it weighed 54,360, it was made to read 54,400 pounds. With the help of the bureau officials at the markets the investigator was able to stay in the field and secure weights on many more shipments of cattle, and with far less expense, than if he had followed each shipment of cattle to their destination.

A record of the method of handling the cattle for several days previous to shipping was kept, taking into consideration the number of miles they were driven to the loading point, how often they were grazed or watered en route, the class of cattle, their condition, and whether they were fed or watered just before loading. Any other items of importance were also noted.

When cattle were on the cars so long that they had to be unloaded for feed and water their weights were secured, when it was possible, before they received feed and water, and again afterwards, and a careful record was kept of this, as well as of the amount and character of food consumed. Thus direct comparison could be made of the shrinkage for the first portion with that of the second portion of the journey, and the fill taken at the unloading station could be compared with that taken at the market.

The investigation was to cover the Southwest the first year. The work was started with the range cattle of Texas in August, 1910, and continued until January 1, 1911, when the shipping of these cattle ceased. Temporary headquarters were then transferred to Oklahoma City, Okla., which was conveniently situated with regard to other places where cattle were being fed, and work was started with cattle fed on cottonseed hulls, cottonseed meal, and corn chop and was continued until the last of February.

ACCURACY OF TRACK SCALES.

At different times during the progress of the work a check was made between the railroad track scales and the platform scales of the Fort Worth Stock Yards to test the accuracy of the track scales. On arrival at Fort Worth the cars of loaded stock were weighed, one at a time, on the track scales, and as soon as they were unloaded

the empty cars were weighed, the difference in the two weights being the weight of the stock. Each carload of cattle was then driven over the platform scales and weighed by the regular weighmaster of the Southwestern Weighers' Association. The results of this check weighing are tabulated here:

Comparison of weight of cattle on railroad track scales and on platform scales at Fort Worth, Tex.

Kind of stock.	Number of head.	Railroad track scale weight.	Platform scale weight.
		Pounds.	*Pounds.*
Calves	65	12,050	12,050
Do	65	12,650	12,850
Do	64	12,600	12,600
Do	138	38,150	38,180
Total calves	332	75,450	75,680
Cows	29	21,250	21,120
Do	35	20,150	20,190
Total cows	64	41,400	41,310

An average of the weights of all the calves shows that they were 0.7 of a pound heavier when weighed on the platform scales than they were on the track scales. The cows averaged 1.4 pounds lighter on the platform scales than they did on the track scales. When account is taken of all the animals weighed, it is seen that there was a difference of only 140 pounds on 396 head of cattle. These weights signify the accurateness of the track scales when cars are carefully weighed "cut loose" at each end and standing still upon the scales. Track scales used at various points for weighing cattle were officially tested at appointed intervals, or whenever there was reason to believe they needed it. In all cases they were found to be very accurate when proper precautions were taken about weighing.

SHRINKAGE IN WEIGHT NOT THE SAME ON ALL CLASSES OF CATTLE

Cattle for the market are divided into two general groups, range or grass cattle and fed cattle. Each of these groups is subdivided into the following classes: Calves, cows, steers, bulls, and mixed cattle.

Range cattle are as a rule restless when penned for shipping and continue so throughout the journey and while in the stockyards. Being used to the open country and not accustomed to man on foot, these cattle are frequently so nervous that they will eat and drink very little if they arrive at the stockyards but a short time before the market opens or while many people are walking about. It frequently happens, however, that when they are unloaded in the dark before people begin stirring in the yards, they will take a good fill.

Different methods are used in the stockyards to get these cattle to fill. If they arrive in the afternoon they may be given a little water and all the hay they can eat at night, and then all the water they will drink just before the market opens. This gives them weight, but does not do away with the drawn appearance so characteristic of this class of stock. As a rule they are fed only hay, as they are unaccustomed to grain and would not eat it.

Cattle which have been fed or finished for the market usually present quite a contrast to the range stock. Docile, accustomed to man and expecting feed from him, these cattle do not show the restlessness of the range stock, and when fed, if weather conditions are favorable, take a nice fill and lie down or stand about in contentment. The shrinkage on fed cattle which have had a very long journey may be rather heavy, because if they are very empty they can not and will not completely fill in a few hours' time. To do this would require at least two days. They will not take enough feed at once to put them back to their weight before shipping.

Cattle that are unloaded but a few hours before the market opens will usually take a good fill, but some look drawn, hard, or haggard even after filling if they have not had time to rest. It must be remembered that a big fill is not always most desirable. Cattle arriving at the market in the afternoon or night may fill, lie down, and not fill as heavily the next morning as cattle arriving about daylight, but they will have rested and do not look stale as might the latter, which took a big fill but got no rest. Rest alone will smooth out the drawn appearance and hard lines caused by travel. Then, too, the cattle which rested overnight and apparently had no large fill, will most likely sell for more than sufficient to offset the difference in weight. The buyer is always on the alert for good cattle with a normal or poor fill and will pay correspondingly higher prices for them than he will for the ones with an abnormal fill, because the poorly filled animals will dress out at a higher percentage.

The shrinkage on the various classes of cattle is not the same even when shipped under identically the same conditions. The difference may not at all times be great, but there is sufficient variation in the shrinkage to justify a close study of each.

It is a recognized fact among cattlemen that, when all other factors are equal, as a rule bulls shrink more than any other class of animals, although cows often come a close second, as they generally shrink more than either heifers or steers. There is usually little difference between the shrinkage on steers and heifers of the same size. The shrinkage on calves is usually small, but when compared to their live weight it runs about the same as with grown animals.

FACTORS AFFECTING SHRINKAGE.

There are many factors, any one of which may affect the loss in weight of cattle during transit. This alone makes the task of comparing the shrinkage of different shipments of cattle a tedious and at the same time difficult problem, as the chance of error is great. One shipment of cattle may show a shrinkage of 20 pounds per head, and a similar bunch of cattle shipped under seemingly the same conditions may show a shrinkage of 40 pounds. While variations are usually not quite so radical as this, it only emphasizes the point that to get an average of the shrinkage of various classes large numbers of animals must be used. The greater the number of cattle used the smaller will be the chance of error.

EFFECT OF THE SEASON.

One of the general factors that affect the shrinkage of cattle in shipping is the character of the season and the effect it has had upon pasture grasses, water supply, etc. During a very dry year, when pasture grasses are short and when the water supply has diminished until it is a long distance between water holes, the animals usually arrive at the loading point practically empty, or with far less than a normal fill. This is especially true if the cattle have been driven a long distance, say from 50 to 75 miles, for they will have had little time to graze and will have secured little feed in the four or five hours' time each day while held along the trail. In consequence of these conditions, the cattle will have shrunk very materially in weight during the drive to the loading pens, and will weigh up light there. Many times, too, the last watering place may be several miles from the loading pens, and as many cattlemen in the Southwest prefer loading their stock without having any water in the pens the cattle weigh up light, and the shrinkage in transit is small. If a good fill is taken at market, the small shrinkage in transit may be completely overcome. Such conditions were experienced throughout Texas in 1910, and the data shown for that year must be considered in the light of these conditions. During a normal year or one with plenty of rain, when grass is abundant and water plentiful, the cattle may arrive at the pens full, or with a normal fill, and absolutely different results in shrinkage will occur. The season is therefore one of the important factors worthy of consideration.

LENGTH AND CHARACTER OF TRAIL TO LOADING POINT.

The distance driven from the farm or the ranch and the methods of driving or caring for the cattle while on the trail may also materially affect the shrinkage. If the cattle were driven some distance

without feed and water and then loaded without being watered, as is quite often done in Texas, the shrinkage in transit will naturally be smaller than on cattle that had all the feed and water they wanted before being loaded. An instance of this kind is found with two shipments of cattle shipped under practically the same conditions after being loaded, but handled differently before loading. In one shipment, from Colorado, Tex., 123 cows were driven 8 miles and penned overnight in a dry lot and loaded next morning without feed or water. They shrank 33 pounds per head while on the cars before taking the fill at market. Another shipment, from Big Springs, Tex., of 90 cows that had been on trail two days with little to eat broke out of the pens at night and grazed and had water until 10 o'clock next morning, when they were rounded up and shipped. They were very full when loaded, and consequently shrank 104 pounds while in transit.

OTHER FACTORS.

As previously mentioned, the class of the cattle is another factor in the shrinkage, as steers do not usually shrink as much as cows of similar weight. The size of the cattle and the degree of fatness also cause variation. Steers weighing 1,000 pounds will shrink more than steers weighing 800 pounds, all other conditions being equal. On the other hand the well-finished or fat animals do not shrink as much as half-fat ones.

The length of time cattle are on the cars also causes variation in shrinkage. Naturally the longer they are in transit the greater will be the shrinkage, but if cattle are in transit over 36 hours the rate of shrinkage is not so great per hundred miles the latter part of the journey as during the first part. The largest shrinkage usually takes place in the first 24 or 36 hours.

The bedding in the cars may affect the shrinkage of the animals somewhat. It is well known that in cars which are well bedded with sand or similar material the cattle stand up much better and do not manifest the restlessness exhibited by animals in a car with no bedding. There is not the slipping, falling, and general uneasiness that occurs when the train is stopping, starting, or catching up slack. A poorly bedded car may do the cattle much injury by making them so tired they will want to lie down immediately upon arrival at market instead of taking a fill. Aside from this there is always the danger of losing an animal which falls in the car by being trampled. It is sometimes a difficult or impossible task for the animal to regain its feet without assistance. This is especially true if it is thin or weak.

Weather conditions affect the shrinkage of cattle perhaps more than any other factor. Where the cattle have access to feed and

water before loading, a severe change of the weather may prevent them from taking any water at all, and they may weigh up light at the point of origin, which will have a tendency to produce a smaller shrinkage than if filled under normal conditions. Then, too, a severe change of weather at the market may likewise prevent the animals from taking a fill.

THE FILL AT MARKET.

The fill taken at market depends largely upon the weather. Cattle arriving at market where everything is coated with snow and ice, or during a blizzard, or when a "norther" is blowing, will usually drink very little water and may eat little feed. They weigh up light and the shrinkage is great. Cold, rainy, windy weather prevents a good fill from being taken. Close, warm, muggy weather is also detrimental to a good fill for fat animals, as they have no appetite and will eat and drink little. If cattle have four hours or more for rest, feed, and water, and the weather is mild, with the sun shining, a good fill is practically assured. Cattle that have had a very long, hard journey have a tendency to lie down soon after reaching the pens, instead of taking a fill. In a case of this kind, if they have several hours' rest, they may then take a good fill. The fill can be increased by giving the animals hay only on arrival and turning them to the water an hour or two before the market opens.

TREATMENT OF CATTLE AT MARKET.

The treatment cattle receive on arrival at the market depends upon the hour of arrival, the class of cattle, and the journey they have had. If they arrive in the afternoon or early night, they may be given a little water and an abundance of hay. Early the next morning water may be turned on and kept before them all day. If the cattle are from the range, they will receive only hay and water. If they are from feed lots, the shipper may have them fed some crushed corn, or other feed early on the morning of sale day.

Cattle arriving just before the market opens or during the morning of the sale day will be turned to feed and water immediately. These animals, unless very weary, usually take a medium fill and are likely to be sold before they lose much of it. The care of the cattle after arrival is in the hands of the commission men, and they can usually be depended upon to see that the animals have every opportunity to take a good fill. It is not always desirable, however, for cattle to have an excessive fill at market, as the buyers are always on the lookout for such animals and will bid correspondingly lower on them. The increase in weight is seldom great enough to overcome the decrease in value of the animals because of their

abnormal fill. The skill of the feeder in such cases is shown by getting the increased weight from fill without giving the animals the appearance of being "stuffed."

DETAILS OF THE WORK.

There are many factors which affect the shrinkage in weight of cattle in transit and the fill at market. To obtain good average results it is necessary that a considerable number of shipments, as well as a large collection of animals should be used. These features were carried out with respect to the range cattle, but the results obtained, as shown in the tables which follow, were ascertained under various conditions on a dry or droughty year and should be considered as such. A variation from the results shown here is to be expected in a normal year or in a year with an excessive amount of rainfall. The pastures of Texas from which the shipments were obtained had been abnormally dry. The data presented, therefore, must be considered as having been produced under conditions more favorable to a light shrinkage while in transit than might otherwise have been obtained under normal conditions.

RANGE CALVES IN TRANSIT LESS THAN 36 HOURS.

The shipments shown in Table 1 were made up entirely of Texas range calves that were shipped to the Fort Worth market and were in transit less than 36 hours. The time in transit as shown in the table is the elapsed time between the weighing at the point of origin and at market. It will be observed that the average length of time in transit was 21 hours, and the grand average fill at market was 9 pounds, while the grand average net shrinkage was really a gain in weight of 3 pounds. The total number of head was 859.

Attention is called to the performance of two shipments included in this table. One from Stanton, Tex., composed of 206 head had been on the road to the loading pens for three days and had been driven 16 hours a day. They looked absolutely empty and jaded when they were loaded and weighed at Stanton. The racks of the cars were filled with hay, and the calves weighed on the average 1 pound heavier when they arrived at Fort Worth than when they started. They took a 13-pound fill there, giving them a net gain in weight of 14 pounds per head. The other shipment was of 64 head from Big Spring, Tex. They were driven but 5 miles and looked well when loaded. They shrank 10 pounds each in transit and continued losing weight until they were sold. They would not take a fill at market, and were 3 pounds lighter when they were sold than when they arrived. Their net shrinkage, therefore, was 13 pounds per head. These two shipments were the extremes of the class, and the variation was not great for the other shipments.

The shipment of 154 calves from Baird, Tex., was in transit but 14 hours, having a much shorter haul to market than the average. During the journey the calves shrank 9 pounds each, but at the market they took a fill of 9 pounds each, which caused the weights at the shipping point and at market to be the same.

The results obtained from a shipment of 47 yearlings from Big Spring in transit 23 hours no doubt reflects somewhat the influence of conditions that existed at the time the investigation was being conducted. The record kept of this shipment, which is not included in the table, shows the animals to have lost 25 pounds each in transit, but upon arrival at market to have filled 53 pounds. This was a net gain of 28 pounds. These yearlings had been on the road to the pens for two days. They had a little hay, but no water, before they were loaded, which offers some explanation for their unusual performance at market.

TABLE 1.—*Texas range calves in transit less than 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hrs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
206	Stanton, Tex.	18	119	120	133	13	[1]+1	[1]+14	Driven 16 hours a day for 3 days. Were empty.
73	Big Spring, Tex.	20	181	169	177	8	12	4	Driven 15 miles. Had water before loading.
75	do	20	150	146	152	6	4	[1]+2	Driven 18 miles. Had water before loading, medium fill.
62	do	20	235	218	227	9	17	8	Driven 18 miles. Had water before loading.
160	do	25	152	146	154	8	6	[1]+2	Driven 7 miles. Fair condition.
65	Colorado, Tex.	22	209	201	210	9	8	[1]+1	Driven 4 miles. Fair condition.
64	Big Spring, Tex.	26	182	172	169	[2]—3	10	13	Driven 5 miles. Would not fill at market.
154	Baird, Tex.	14	194	185	194	9	9	0	Driven 5 miles. Water in pens.
	Grand average.	21	166	160	169	9	6	[1]+3	

[1] Gain in weight instead of a shrinkage. [2] Loss in weight instead of gain by fill.

RANGE COWS IN TRANSIT LESS THAN 36 HOURS.

All of the shipments contained in Table 2 were composed of Texas range cows that had been in transit less than 36 hours. The average length of time as disclosed by the grand average in the table was 21½ hours. The total number of head was 509. There is a rather wide variation in the individual shrinkage and fill, although the averages do not show it to any appreciable extent.

It will be observed that there is a sharp division in the net shrinkage results, one-half of the shipments experiencing gains after the fill at market, while the other half approach somewhat nearer a normal shrinkage.

Three of the shipments show a rather unusual performance: The shipment of 92 head gained 5 pounds each at market; the shipment of 28 head experienced a fill at market equal to the shrinkage in transit; and the shipment of 90 head filled 88 pounds each at market which cut down the rather heavy shrinkage of 105 pounds to 17 pounds net.

The shipment in the table showing the least fill is that of 123 head which filled only 5 pounds each. The records show these cattle to have been sold soon after they were unloaded at market, which did not enable them to eat or drink much, and explains why the fill at market was so light.

Of particular interest is the performance of 90 head that experienced a gross shrinkage of 105 pounds each. The history of this shipment, as disclosed by the record, shows the cows to have been driven a considerable distance to the loading station and there confined without having been given any water. They broke down the fence that night, and scattered several miles over the range. They had plenty of grass and water until rounded up the next morning at ten o'clock. The fill was so great that the shrinkage in transit was naturally heavy, but, as shown in the table, the fill at market was sufficient to reduce the net shrinkage to 17 pounds each.

The average shrinkage in transit of the 509 head of cows was 56 pounds, of which 42 were regained by fill, leaving a net shrinkage of 14 pounds per head. All the shipments were sent to the Fort Worth market.

TABLE 2.—*Texas range cows in transit less than 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hrs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
30	Big Spring, Tex...	20	817	774	829	55	43	[1]+12	Driven 15 miles. Had no water for 24 hours before loading.
30	.....do.....	20	706	672	714	42	34	[1]+ 8	Driven 1 mile.
30	.....do.....	20	711	646	671	25	65	40	Driven 18 miles. Had water in pens.
92	.....do.....	25	646	608	651	43	38	[1]+ 5	Driven 7 miles. Cows poor.
28	.....do.....	22	811	775	811	36	36	0	Driven 4 miles. In medium flesh.
86	.....do.....	24	787	716	763	47	71	24	Driven 30 miles. Fed hay night before shipping.
123	.....do.....	18	724	690	695	5	33	28	Driven 8 miles without water. Sold soon after arrival at market.
90	.....do.....	22	829	724	812	88	105	17	Driven 2 days. In good flesh.
	Grand average.	21½	749	693	735	42	56	14	

[1] Gain in weight instead of a shrinkage.

MIXED RANGE CATTLE IN TRANSIT LESS THAN 36 HOURS.

The shipments of Table 3 were in transit for an average of 22 hours. The average weight of the 791 head was 589 pounds, being small because of the admixture of calves and yearlings with these cattle. Further evidence of the abnormal conditions that prevailed when the shipments were made is shown by the results in this table. The first shipment of 29 cattle from Colorado, Tex., had a good fill when loaded and shrank 50 pounds per head in transit, and when put on feed at market would not fill, taking on but 1 pound per head before being sold. The result was they showed a large loss in weight. The same was true of the 35 head from Big Spring, except these continued to shrink after reaching market, weighing 6 pounds lighter when sold than on arrival.

The reverse, however, is true of four of the shipments, which took a fill at market greater than the shrinkage in transit, leaving the cattle heavier when sold than when loaded at the point of origin. This was due to a certain extent to bad treatment in handling the cattle previous to loading. The shipment of 169 cattle, for instance, had been on the trail for 5 days previous to loading, with very little to eat or drink. Another consignment had no water for 30 hours before being loaded and, of course, weighed up very light. The consignment of 141 head were thin cows that had been trailed 2 days with very little grass or water. When conditions of treatment are such as just named, it is only to be expected that cattle will be very empty and weigh up light at the loading pens, and if they get a chance to fill well at market, the fill may overcome the small shrinkage experienced in shipping.

The grand average presents the fact that the cattle shrank 34 pounds in transit, and subsequently filled 31 pounds at the market, leaving a net shrinkage of but 3 pounds per head. The results reported in Table 2 show that the shrinkage was 11 pounds greater per head on cows weighing 750 pounds than on mixed cattle, which were almost 200 pounds smaller.

In addition to the cattle recorded in the table, we have a record of 34 head, loaded at Colorado, Tex., which were 25 hours in transit and weighed 675 pounds per head on loading and 671 pounds when sold at market, thus showing a net shrinkage of 4 pounds. These cattle had no water for 15 hours before loading, but as the record of shrinkage and fill at market were not secured, they are omitted from the table.

TABLE 3.—*Mixed range cattle in transit less than 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hrs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
29	Colorado, Tex.....	21	865	814	815	1	51	50	Good fill at Colorado; would not fill at market.
35	Big Spring, Tex....	27	561	534	528	[1] −6	27	33	Did not fill any at market.
169	.....do.....	23	576	551	582	31	25	[2] +6	On road 5 days; empty when loaded.
71	Colorado, Tex.....	18	575	537	577	40	38	[2] +2	Had no water for 30 hours before loading.
141	Big Spring, Tex....	22	561	540	573	33	21	[2] +12	Cattle poor; on road 2 days.
159	.....do.....	21	589	554	588	34	35	1	Fed some hay but no water.
86	.....do.....	23	787	716	763	47	71	24	Fed and watered night before shipping.
28	.....do.....	23	811	759	815	56	52	[2] +4	Fat stuff.
73	.....do.....	20	269	250	269	19	19	0	Calves and yearlings; driven 18 miles.
	Grand average..	22	589	555	586	31	34	3	

[1] This is a loss in weight after fill instead of a gain. [2] This is a gain in weight instead of a shrinkage.

RANGE CALVES IN TRANSIT OVER 36 HOURS.

Table 4 presents the weights and shrinkages on range calves during the second period of their transit to market. In no instance was the original weight secured at the loading point, as there were no scales at any of the towns, but upon arrival at their first feeding station the calves were weighed. All of these calves were unloaded for feed and water at Big Spring, Tex., where they took a fill of 10 to 16 pounds each. The run from Big Spring to the Fort Worth market required from 22 to 26 hours.

It is seen that the average shrinkage in transit ranged from 8 to 11 pounds per head, being very uniform in all of the lots. The fill taken at market ranged from 10 to 17 pounds per head, or practically the same as that taken at Big Spring. In every case the fill taken at market overcame the shrinkage in transit, so the calves weighed heavier at market than they did at the feeding station.

The grand average of the 475 calves gives a weight of 209 pounds at the feeding station, a shrinkage of 10 pounds before fill at market, and a net gain of 4 pounds each when sold. The grand average of Table 1 gave instead of a net shrinkage on calves for the first period of 21 hours a gain in weight of 3 pounds, while Table 4 shows instead of an average net shrinkage for the second portion of the journey, consisting of 24 hours, a gain of 4 pounds in weight.

TABLE 4.—*Range calves in transit over 36 hours.*

Number of head.	Point of origin.	Time in transit, first period.	Average weight at point of origin.	Average weight at feeding point before fill.	Time in transit, second period.	Average weight at feeding point after fill.	Average weight at destination.	
							Before fill.	After fill.
		Hours.	*Pounds.*	*Pounds.*	*Hours.*	*Pounds.*	*Pounds.*	*Pounds.*
65	Valentine, Tex.....	26	.....	.....	22½	207	198	214
65	.....do.....	26	.....	.....	22½	193	185	202
64	.....do.....	26	.....	.....	22½	205	197	213
201	Marfa, Tex.....	33	.....	194	26	204	194	204
80	Valentine, Tex.....	28½	.....	230	26	236	225	242
	Grand average..	28	.....	.....	24	209	199	213

Number of head.	Point of origin.	Average fill at market.	Average shrinkage.		Remarks.
			Before fill.	After fill.	
		Pounds.	*Pounds.*	*Pounds.*	
65	Valentine, Tex.....	16	9	[1] +7	High grade Herefords. On feed 12 hours at Big Spring, Tex.
65	.....do.....	17	8	[1] +9	Do.
64	.....do.....	16	8	[1] +8	Do.
201	Marfa, Tex.....	10	10	0	Fat calves. Filled 10 pounds at Big Spring.
80	Valentine, Tex.....	17	11	[1] +6	Fat calves. Driven 8 miles.
	Grand average..	14	10	[1] +4	

[1] Gain in weight instead of a shrinkage.

MIXED RANGE CATTLE IN TRANSIT OVER 36 HOURS.

The 1,310 head of range cattle of Table 5 presents the same variations that are shown in Table 3, where mixed range cattle were in transit less than 36 hours. All of these cattle had been in transit from 26 to 72 hours when they were unloaded for feed, water, and rest. Of the total number, 566 head were weighed upon arrival as well as upon leaving Big Spring, Tex., where they were fed and watered. This weighing showed the fill taken at Big Spring to average 57 pounds per head, which was an unusually large fill for so many cattle. The average fill taken at the market was 38 pounds per head. This is considered a medium or good fill on this class of cattle.

The shrinkage in transit varied from 12 pounds a head on a load of yearlings to 39 pounds per head for the 16 cars of steers from Haymond, Tex., and the 16 carloads of cows from Mexico. Unless the droughty year is considered, the shrinkage in transit on all of the cattle would seem extremely small. The shrinkage on most of them was very uniform.

The average amount of fill taken at market varied much more. This ranged from 18 pounds with the car of yearlings to 62 and 57 pounds, respectively, with two cars of cows from Alpine, Tex., one

of which shrank 35 pounds in transit, leaving a net gain of 27 pounds per head, and the other shrank 33 pounds per head, leaving a net gain of 24 pounds per head over the first weight taken. These fills were exceedingly large. The car of 51 yearlings took a fill of 35 pounds per head at the unloading point and a fill of but 18 pounds at market. The rest of the cattle took fills which are considered about normal.

A close study of the table reveals the fact that when all of the cattle are considered they made a net gain in weight of 3 pounds per head for the second period of 36 hours in transit. It will be remembered that Table 3 revealed a loss of 3 pounds per head on the same class of cattle for the first 36 hours in transit.

The weather continued good from the time all of these cattle were started to market until they were sold.

TABLE 5.—*Mixed range cattle in transit over 36 hours.*

Number of head.	Point of origin.	Time in transit, first period.	Average weight at point of origin.	Average weight at feeding point before fill.	Time in transit, second period.	Average weight at feeding point after fill.	Average weight at destination.	
							Before fill.	After fill.
		Hours.	*Pounds.*	*Pounds.*	*Hours.*	*Pounds.*	*Pounds.*	*Pounds.*
29	Alpine, Tex.	26	.....	.....	22½	763	728	790
35	.....do.	26	.....	.....	22½	609	576	633
132	Haymond, Tex.	31	.....	462	22	527	495	526
383	.....do.	31	.....	535	22	592	553	598
51	.....do.	31	.....	277	22	312	300	318
141	Big Spring, Tex [2].	.....	.....	.....	46	561	540	573
539	San Tomas, Mex.	72	.....	.....	27	592	553	589
	Grand average..	36	.....	.....	26	575	540	578

Number of head.	Point of origin.	Average fill at market.	Average shrinkage.		Remarks.
			Before fill.	After fill.	
		Pounds.	*Pounds.*	*Pounds.*	
29	Alpine, Tex.	62	35	[1] +27	Cows. Took big fill at market.
35	.....do.	57	33	[1] +24	Do.
132	Haymond, Tex.	31	32	1	Held on hay and water 3 days before shipping.
383	.....do.	45	39	[1] + 6	Do.
51	.....do.	18	12	[1] + 6	Yearlings. On feed 11 hours at unloading point.
141	Big Spring, Tex [1].	33	21	[1] +12	Had no feed for 10 hours before weighing at Big Spring, Tex.
539	San Tomas, Mex.	36	39	3	Mixed Mexican cattle in medium flesh.
	Grand average..	38	35	[1] + 3	

[1] Gain in weight instead of a shrinkage. [2] Shipped to Kansas City.

CATTLE IN TRANSIT SEVERAL DAYS.

Sometimes there are consignments of cattle originating in Arizona, New Mexico, western Texas, and Mexico which go to the Kansas City market. Several days are required to make this trip, which is a very hard one on the cattle. This is especially true if the

cattle originated in Mexico, where some of them may have been held without feed or water for quite a long period while the rest were being gathered for shipping. In Table 6 are shown the data from the shipping of 588 head of these cattle. The weights at the points of origin were not secured, but the weights were taken the second day of the trip when the cattle were unloaded for feed and water. To make the trip from this point to Kansas City required 105 hours, or over four days' time. The first shipment of cattle had no feed for 10 hours before the first weight was taken and they shrank but 42 pounds in transit, gaining back 35 pounds of it from fill and having a net shrinkage of but 7 pounds per head.

The other shipment was a whole train of 524 head of high-grade Hereford cattle from Blue, Ariz. They had been in transit 17½ hours from Blue to El Paso, where they were given feed and water for 30 hours, and took a nice fill. They left El Paso at 6 o'clock p. m. in a "norther," and soon ran into a snowstorm which lasted practically all the way to Kansas City. The weather was extremely cold, but despite this fact the cattle took a good fill at Kansas City, as they had been on the cars so long with very little to eat. The net shrinkage was 42 pounds per head for this long journey.

TABLE 6.—*Mixed cattle in transit several days.*

Number of head.	Point of origin.	Time in transit, first period.	Average weight at point of origin.	Average weight at feeding point before fill.	Time in transit, second period.	Average weight at feeding point after fill.	Average weight at destination.	
							Before fill.	After fill.
		Hours.	*Pounds.*	*Pounds.*	*Hours.*	*Pounds.*	*Pounds.*	*Pounds.*
64	Big Spring, Tex	.....	.....	.....	104½	717	675	710
524	Blue, Ariz	17½	.....	.....	105	520	448	478
	Grand average	.....	.....	.....	105	541	472	502

Number of head.	Point of origin.	Average fill at market.	Average shrinkage.		Remarks.
			Before fill.	After fill.	
		Pounds.	*Pounds.*	*Pounds.*	
64	Big Spring, Tex	35	42	7	Had no feed for 10 hours before loading.
524	Blue, Ariz	30	72	42	In a raging blizzard from El Paso to Kansas City.
	Grand average	31	69	38	

FED CATTLE IN TRANSIT LESS THAN 36 HOURS.

Of all cattle which are shipped to market those which are finished in the feed lot should shrink more uniformly. There are several reasons for this: (1) They have had practically the same treatment

for several months before shipping; (2) they have been on feed usually until a short time before loading, and the fill at the point of origin should be more uniform than with range cattle; (3) the cattle are generally fed near the loading pens and do not have to be driven long distances before shipping; (4) they are accustomed to man on foot and to feed-lot conditions and should, for these reasons, take a much more uniform fill at market when all other factors are the same.

For the above reasons it is also possible for the owner to control, to some extent, the shrinkage of his cattle by judicious care in feeding and watering just previous to shipping, whereas the shipper of range cattle can not always do this.

All of the cattle which were used to get the data for Table 7 were steers that had been fed for an average period of 120 days. They were all high-grade Hereford and Shorthorn steers, ranging from 2 to 4 years old, and showing quality above the average for range steers. The ration on which they were fed was cottonseed hulls and cottonseed meal for the first 75 days, with some corn chop added after that time. At the time they were shipped they were receiving about 6 pounds of cottonseed meal, 10 pounds of corn chop, and all the hulls they would consume, which was about 28 pounds each per day.

These steers were fat when shipped; most of them would have classed as "choice" and some would have ranked as "prime" on the Kansas City market. Each shipment was composed of steers which had been cut from the whole herd in such manner as to secure uniformity in size and quality. The care used in the cutting out and loading was extreme, and showed a combination of the skill of a ranchman and the judgment of a feeder. Each consignment of cattle consisted of 5 to 10 carloads, so the results secured from each shipment should be fairly conclusive for the conditions under which they were shipped.

The steers ranged from 1,155 to 1,320 pounds in weight, showing an average of 1,266 pounds. They were in transit from 22½ to 26 hours, and all had very good runs to market. The shrinkage in transit was very uniform, ranging from 61 to 76 pounds each, or a difference of only 15 pounds between the extremes. The fill taken at market was not uniform because of weather conditions. Every shipment was made during very cold weather and while snow was on the ground from 4 to 5 inches deep. For this reason none of the cattle filled well at Kansas City. The first two shipments filled practically the same, as conditions at market were the same.

When the next two shipments were made everything was frozen up or coated with ice at the market. The steers were given Missouri River water, which they would not drink, and were fed 6 pounds each of prairie hay. They were sold two hours after arrival and filled but 9 and 13 pounds, respectively. The result was that the

net shrinkage was very high on these two shipments. The last shipment did little better, as the conditions were almost the same. The shipment of heaviest steers, which should have filled the most, was the one that arrived during the height of a blizzard and filled only 9 pounds per head. Their net shrinkage was the largest, being 67 pounds per head.

The grand average for all of the 680 head shows they were in transit for 24 hours, shrank 71 pounds in transit, and filled but 14 pounds, leaving a net shrinkage of 57 pounds. This was 4.5 per cent of their live weight. None of the shipments were at the market over four hours before being sold, and one shipment was on the market only 1½ hours, which may account to a certain extent for the small fill taken and consequently the larger net shrinkage.

TABLE 7.—*Cottonseed-meal-fed cattle in transit less than 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hrs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
125	Oklahoma City, Okla.	26	1,196	1,135	1,155	20	61	41	Had but 1½ hours to fill at market.
115	.....do.....	26	1,281	1,210	1,231	21	71	50	Cold, with 5 inches snow at market. Sold 2 hours after arrival.
220	.....do.....	21½	1,319	1,243	1,252	9	76	67	Everything frozen up at market. Steers took no fill.
220	.....do.....	22½	1,245	1,173	1,186	13	72	59	Given Missouri River water at market, which they would not drink.
	Grand average.	24	1,266	1,195	1,209	14	71	57	

FED CATTLE IN TRANSIT OVER 36 HOURS.

In Table 8 are shown the results of shipping 616 head of fed cattle which were in transit 36 hours or over. All of these cattle were shipped to the St. Louis market. Each consignment was made up of two to seven cars of steers which had been on feed from 100 to 120 days. All of them were high-grade Hereford and Shorthorn steers of good quality, and were fat. The ration consisted of cottonseed meal, cottonseed hulls, and corn chop.

The steers of the various shipments ranged from 733 to 1,059 pounds in weight, averaging 862 pounds. The weights on arrival at St. Louis could not be secured, as the commission firm to whom they were consigned positively refused to allow them to be weighed. It might be stated here that this was the only firm at any market that refused to let cattle be weighed on arrival, when written permission had been secured from the shipper.

The first four shipments enumerated in this table were all from the same feed lot in Wagoner, Okla., so the treatment of all was

the same for 100 days previous to marketing, and the conditions during shipment were the same. All were of about the same weight and quality and were in transit practically the same time. For these reasons the shrinkage would naturally be expected to be almost similar. The weather at market was without change during the first three shipments, but the fourth shipment arrived in a raging blizzard, one of the worst of the winter, and the cattle ate little and drank none. Snow was deep, everything was frozen over, and a biting wind was blowing. The results are clearly shown in the net shrinkages. For the first three shipments the shrinkage was very uniform, being 47, 52, and 49 pounds, respectively. Owing to the blizzard, the shrinkage on the fourth shipment amounted to 73 pounds per head because of the failure to fill, or an increase of 24 pounds each in shrinkage over the first three lots.

The two shipments from Oklahoma City were from the same feed lot as were all of the steers shown in Table 7. They were about the same in quality and degree of fatness but were smaller in size than the ones shown in Table 7, so were shipped to the St. Louis market instead of to Kansas City. These cattle are therefore directly comparable to those of Table 7.

The shrinkage on the two shipments to St. Louis was 54 and 61 pounds, respectively, or an average shrinkage of 57 pounds for the 46½ hours' journey. The average weight was 1,077 pounds. The average shrinkage of the 680 head shipped to Kansas City was also 57 pounds each, but they were about 200 pounds heavier, and the journey was of but 24 hours' duration. These figures clearly and conclusively show that the greater part of the shrinkage on these cattle occurred during the first 24 hours of the journey.

The grand average of all consignments in Table 8 shows the average time in transit to be 40 hours, the average weight to be 862 pounds, and the net shrinkage to be 59 pounds per steer.

TABLE 8.—*Cottonseed-meal-fed cattle in transit over 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination after fill.	Average shrinkage.	Remarks.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	
112	Wagoner, Okla.	36	842	795	47	Fed 120 days. Weather was fine.
117	do	36	813	761	52	Do.
83	do	37	849	800	49	Fed 125 days. Weather was good.
209	do	37	806	733	73	Arrived at market in a raging blizzard and would not fill.
47	Oklahoma City, Okla.	46	1,034	980	54	Had been on feed over 100 days.
48	do	46	1,120	1,059	61	Cold disagreeable weather at market. Took a light fill.
	Grand average	40	862	803	59	

SUMMARY OF SEASON'S WORK.

Table 9 is a condensed statement of all the preceding tables. In it are tabulated the shrinkage data on nearly 6,000 head of cattle. It must be remembered that the year in which this work was done was a very dry one, with little grass, which was conducive to a poor fill at origin and a small shrinkage in transit for range cattle. It caused no variation at all with the feed-lot cattle.

In the first figure column of the table is shown the number of shipments made of each class of animals, while the number of cattle in each class is shown in the second column. This number ranged from 475, which were calves in transit over 36 hours, to 1,310, which were mixed cattle from 36 to 72 hours in transit. Column 3 presents the average weight at the point of origin. Columns 4 and 5 present the gross shrinkage, or the shrinkage in transit. This gross shrinkage varies greatly with the various shipments of range cattle. The greatest variation was with cows, the shrinkage of which ranged from 33 to 105 pounds. There was very little variation in the shrinkage of the feed-lot cattle.

The fill at market was also quite variable with the range cattle but more uniform with the fed cattle. The average fill on the calves was 9 pounds on one lot and 14 on the other. The largest fill was taken by range cows and the smallest was naturally taken by the calves.

The small fill, 14 pounds per head, taken by the fed cattle at market is to be noted. The conditions at market were most unfavorable for a fill on every shipment of these cattle. All of them arrived when everything was coated with snow and ice.

With two exceptions, the weather was good when all shipments of range cattle were moving to market. Two shipments which were destined for Kansas City were caught in snowstorms and their shrinkage was heavy when compared with the other shipments.

The variations in the net shrinkages were quite wide for the different shipments. The greatest variation was found with the mixed range cattle in transit less than 36 hours, and the next greatest with the range cows. The difference was not so great with the calves, nor with the fed cattle. The variation was greater with the fed cattle which were in transit over 36 hours than with the ones in transit for a shorter period. This was because of the excessive net shrinkage, 73 pounds, on a single shipment which would not fill at market.

The average net shrinkage for all of the range cattle was small. All of the 1,334 calves actually took enough fill at market to overcome the shrinkage in transit, and they gained in weight. The same was true of the mixed range cattle in transit from 36 to 72 hours, while the range cattle in transit less than 36 hours lost 3 pounds each in weight. There was a loss of 14 pounds per head on the range cows.

One large shipment of cattle in transit 105 hours was in a snowstorm for four days, which increased the shrinkage quite a little over that shown by the other classes. At the points where these cattle were unloaded for feed and water they were given some prairie hay, but the water pipes were all frozen, so they got practically no water. At market they filled 30 pounds per head despite the weather.

The fed cattle in transit under 36 hours shrank 57 pounds per head, while those in transit over 36 hours shrank 59 pounds each. This was not a large shrinkage for this class of cattle.

TABLE 9.—*Summary table for 1910–11 work.*

Description of shipments.	Number of shipments.	Number of cattle.	Average weight at origin.	Gross shrinkage.		Fill at market.		Net shrinkage.		Ratio of shrinkage to live weight at origin.
				Range.	Average.	Range.	Average.	Range.	Average.	
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
Range calves in transit less than 36 hours	8	859	166	[1] +1–17	6	[2] −3–13	9	[1] +14–13	[1] +3	[1] +1.8
Range calves in transit over 36 hours	5	475	209	9–11	10	10–17	14	+ 9– 0	[1] +4	[1] +1.9
Rangecows in transit less than 36 hours	8	509	749	33–105	56	5–88	42	[1] +12–40	14	1.9
Mixed range cattle in transit less than 36 hours	9	791	589	19–71	34	[2] −6–56	31	[1] +12–50	3	.5
Mixed range cattle in transit 36 to 72 hours.[3]	7	1,310	575	12–39	35	18–62	38	[1] +27– 3	[1] +3	[1] +.5
Mixed range cattle in transit 105 hours	2	588	541	42–72	69	30–35	31	7–42	38	7.0
Cottonseed-meal-fed steers in transit less than 36 hours	4	680	1,266	61–76	71	9–21	14	41–67	57	4.5
Cottonseed-meal-fed steers in transit over 36 hours	6	616	862	.....	.....	.....	.....	47–73	59	6.8

[1] Gain in weight instead of a shrinkage.
[2] Cattle did not fill at all but continued losing weight.
[3] Cattle were in transit 54 to 72 hours, but the figures are for the second portion of the journey, and not for the total time in transit.

CONCLUSIONS.

The following conclusions may be drawn from the season's work:

1. The shrinkage of cattle in transit is influenced very materially by the following factors:

(*a*) The character of the season. If a season has been so dry that grass is short and water holes far apart, the shrinkage may be small unless feed and water are given just before shipping.

(*b*) The distance driven to the loading pens and the care used when making the drive.

(*c*) The fill at the shipping point. If the cattle have had no grass and water for several hours before loading and weighing, they will naturally have a small shrinkage in transit. But if they

have plenty of grass and water before weighing, there will usually be a heavy shrinkage.

2. The shrinkage is not the same for all classes of cattle. It will be greater on cows than on either steers or mixed stuff, and smaller on calves than on any other class of cattle.

3. The shrinkage will usually be in direct proportion to the size of the animals, where all other factors are equal.

4. The weather exerts a primal influence on the shrinkage of cattle while in transit, and upon the fill taken at the market.

5. The greater the fill taken at market the smaller will be the shrinkage.

6. The fill at market may be influenced by the weather, the time elapsed since the cattle were last fed and watered, the time of arrival at market, and the feeds given while there.

7. A big fill of grass and water at the point of origin just previous to loading is not desired. The cattle will not stand up well, and it may cause them to scour.

8. The practice of withholding feed and water for from 10 to 25 hours before loading, in order to make the cattle take a big fill at market, is to be condemned. Very frequently the fill is not taken, and usually the shipper loses money by this procedure.

9. In a droughty year the shrinkage of the cattle largely takes place during the drive from the ranch to the loading pens. The shrinkage in transit may be small and may be completely overcome by the fill at market.

10. The variation in shrinkage of fed cattle is not as wide as that on range cattle, and the fill at market of the fed cattle is more uniform.

11. The shrinkage of cattle finished on cottonseed meal, hulls, and corn chop is greater than the shrinkage on range cattle.

12. The shrinkage of cattle is much greater during the first 36 hours in transit than during any subsequent period of the same duration.

II. NORTHWESTERN SHRINKAGE WORK OF 1911–12.

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INTRODUCTION.

This part of the investigation was started in September, 1911, and covered a large portion of the western cattle-producing districts. The work was carried out with the same facilities and under the same conditions that are offered to every shipper. No effort was made to influence results one way or the other, nor was there any attempt made to deviate from the regular order or methods peculiar to the section of the country where the animals originated. The aim of the investigation was to get at the facts with respect to the shrinkage in transit and the fill at market. The results obtained were based on shipments made in various sections of the country under varying conditions, with cattle of different breeds, fattened on several kinds of feed.

No attempt was made to gain control of the shipments or to influence or advise the owner how the stock should be treated. Permission was asked to weigh the animals at the point of origin and again on arrival at market. Care was always exercised to avoid any extra shrinkage by reason of the weighing or to divert the cattle in any way that would place them in a less favorable position as compared with other shipments not weighed. The object was to handle them in a normal manner without regard to what the outcome might be, so as to secure accurate results under the prevailing conditions.

HOW THE DATA WERE OBTAINED.

The investigation was begun in the vicinity of Sheridan, Wyo., in September, 1911. At that time the cattle from the ranges of Wyoming and Montana were being sent to market. The work of collecting the weights of shipments originating in that section of the country was continued until November, when headquarters was shifted to Alliance, Nebr. From this point the work was continued with shipments from the sandhills of western Nebraska. The shipping season practically closed in December and headquarters was again shifted to Boone, Iowa, where shipments from feed lots in different parts of the State were obtained. The last move was made in April, 1912, to Jacksonville, Ill., where the work was finished in June.

In February, 1912, trips were made to Billings, Mont., Brush and Fort Morgan, Colo., where weights were secured of shipments from these points to various markets in the Middle West of cattle fattened on sugar-beet pulp.

The greatest handicap encountered was the lack of scales at points of origin; especially was this true in the range States. There are but few platform scales in these States and the weights obtained of the range-fattened cattle of Wyoming, Montana, and Nebraska were nearly all on railroad scales. The weights of the pulp-fed, corn-fed, and silage-fed cattle were all obtained on platform scales and are what are commonly known as "hoof weights."

In taking weights of cattle on railroad scales care was exercised in getting as near the correct weight as possible. It is customary with some railroads in weighing freight to keep the cars coupled together and not take into account fractional parts of weights registering under 100 pounds. For example, if a loaded car weighed 55,540 pounds, the weight would be set down as 55,500 pounds and the odd 40 pounds disregarded. Moreover, the cars being coupled together at the time would also influence the weight, depending on whether the draft of the drawbars was up or down on the car weighed.

It was obvious that such a method would not furnish data sufficiently accurate for an investigation where every pound was a factor in the final results, nor would such weights furnish reliable figures to compare with the careful weights taken on platform scales at market. Hence it was found necessary in weighing on railroad scales to uncouple all cars weighed, so as to have both ends free. A careful balancing of the beam was observed and with the scales breaking at 10 pounds the weights thus secured were as accurate as the facilities would permit.

The method followed where shipments were weighed on railroad scales was to weigh the empty cars after they had been bedded. The cattle were then loaded and weighed in the cars. The weight of the car before it was loaded was subtracted from the weight of the loaded car and the result represented the weight of the animals at the point of origin.

A brief history of the cattle was taken from the owner and a note made of the conditions under which they had been trailed and loaded. Arrangements were made with bureau employees at the stockyards at the various markets whereby the cattle were weighed promptly on arrival before any feed or water had been given them, the owner giving his consent to have this done. The weights on arrival before the fill and the sale weights taken after the fill at market, together with the time of arrival, were sent to the writer, who entered them into the record of the shipment.

THE FILL AT MARKET.

Under the present system of marketing beef animals the amount of weight taken on after their arrival and before their sale is allowed the shipper by the purchaser. This extra weight is produced by feeding and watering soon after the cattle are released from the cars. The more the animals eat and drink after arrival and before sale the greater will be the weight taken on. Every pound of weight thus taken on has an equivalent in money, so that the fill at market is important to the shipper in that it is a distinct gain. Furthermore, every pound of fill at market reduces in like proportion the shrinkage that has taken place while the cattle were in transit. Thus, if a steer shrinks 50 pounds from point of origin to market and fills 25 pounds before it is sold there is but 25 pounds net shinkage to represent the transfer from farm to market.

There is no method of insuring a good fill at market that is practical or humane. As an old feeder and shipper once remarked, "One can never tell what a steer will do." This statement was predicated on long experience, and its truthfulness is attested by many other shippers. Some call a good fill luck, but it is not to be denied that conditions play a prominent part. If a system of handling could be perfected whereby a good fill at market could be counted on the shippers of beef cattle would have a difficult problem solved that is costing them no small amount of money and effort.

The prevailing custom at the market places in this country affords ample opportunity for cattle to eat and drink liberally. Animals may continue to fill from time of arrival until sold, and the amount they consume is not restricted by any stockyards rule or regulation. It is of interest in this connection to note the rules and regulations prevalent in two European countries.

CUSTOMS IN SOME FOREIGN COUNTRIES.

In Germany meat food animals in the stockyards at the principal markets can not be fed after 8 o'clock in the morning. This rule is in effect until the animals are sold or the market closes for the day, which is generally about 4 o'clock in the afternoon. In some sections of Germany animals in the stockyards may not be fed after 7 o'clock in the morning until the market closes. Another interesting regulation now in force in Munich and quite generally throughout Germany has to do with the quantity of feed that may be given each animal at feeding time after arrival at the stockyards.

The following is translated from the "Feeding Regulations" of the public stockyards in Munich, Germany:

1. The feeding of live stock in the stockyards must not take place between the hours of 8 a. m. and 4 p. m.

2. The feeding and watering of animals must be performed by the owner or his agent. Only feed delivered by the employees of the stockyards may be used.

3. All feed shall be apportioned at each feeding as follows:

(*a*) For 1 head of cattle, 5 kg. (11 pounds) of hay.

(*b*) For 1 sheep, ½ kg. (about 1 pound) of hay.

(*c*) For 1 hog, ½ kg. (about 1 pound) corn or barley.

(*d*) For 1 calf, ½ kg. (about 1 quart) meal mash.

4. The prices charged for the feed rations mentioned in paragraph 3 shall be fixed at the beginning of each month by the stockyards management and displayed about the stockyards.

5. For attendance and care and for bedding no fee shall be charged.

6. For feeding animals at other than the regular time an extra fee shall be charged, payable at the time in cash.

7. Feed or litter left in the pens, stalls, or yards may be utilized by the incoming occupant without charge.

In the principal live-stock markets of France regulations very similar to those of Germany prevail with respect to the time when animals may be fed and watered. These regulations apply to stock imported from adjacent or neighboring countries as well as native or home-grown animals.

THE TIME OF ARRIVAL AT MARKET.

The investigation revealed the fact that the time of arrival at market is an important factor in the fill. It was observed that cattle arriving at a late hour in the night do not take on as much weight as those arriving around 5 o'clock in the morning. This is especially true in winter. Cattle arriving in the early morning appear more eager to eat and drink, while those arriving at a late hour in the night when the weather is cold and a raw wind is blowing generally lie down before daylight arrives. Such cattle are disposed to remain in that position, if not disturbed, until the morning sun warms the atmosphere, and if the morning is cloudy or stormy they will remain lying down and, as a rule, appear indifferent to feed and water unless very hungry.

There is quite naturally a difference in the disposition of cattle from the range as compared with those from the feed lots. This difference in disposition is manifested on their arrival at the market as well as elsewhere. For example, cattle fattened on the western ranges, where they are practically unrestrained from birth to maturity and seldom see a man afoot, are not handled as easily as animals more domesticated. Their transfer from range to market is one constant strain. On arrival they are confined in strange quarters, the surroundings of which are occupied with strange cattle. If they are unloaded during the night they do not lie down unless fatigued with their journey. The result of this is that they are not disposed to fill very much unless very hungry.

On the other hand, cattle arriving after daylight, from 5 to 7 o'clock in the morning, without respect to whether they are from the range or the feed lots, were observed to fill more readily. In other

words, if cattle can be unloaded from the cars into the feeding pens at the market and fed promptly at somewhat near the hour of their usual feeding time, it has been noticed that they will take on a better fill than when unloaded at night. This, however, is subject to weather conditions on arrival. But the nearer the animals can follow their former hour of feeding the more naturally they will consume their usual quantity. As a rule, after having taken on the fill cattle will lie down and rest. If unloaded after daylight and fed promptly they will have sufficient time to eat and drink liberally and have a good rest before the market formally opens. The fill and the rest are both important to the shipper. Where this plan could be followed it was noticed that the animals presented a better physical appearance. The hollow spots produced by the fatigue of the journey were filled out and their general appearance was more smooth.

Hence, the nearer the regular feeding and watering time at home can be adhered to at the market yards, with good weather prevailing, the more satisfactory will be the fill. If the shipper is fortunate in arriving at a favorable hour with his cattle and can secure a natural fill he will have accomplished about all that can be expected under present methods of marketing.

GUARDING AGAINST SHRINKAGE.

All of the precautions to protect cattle from heavy shrinkage in transit may be made useless by some incident of the trip that is beyond control. As a matter of fact, when a shipper loads his animals aboard the cars for market it is largely a matter of chance as to how much weight they will lose during the journey. It was observed that some shippers exercised care in guarding against a heavy shrinkage, while others were indifferent, and the final results at market were not always in favor of the shipper who was careful. However, it is not intended to convey the idea that care and effort are not without their reward, but it sometimes happens that the painstaking shipper suffers loss that is not visited on the indifferent shipper. It is merely one of the fortunes of the business occasioned by the elements of chance that enter into the transferring of the animals from the farm to the market.

There are certain established methods of handling stock destined for market that are no doubt responsible for a lighter shrinkage in transit than would otherwise be the case. In this the railroads have endeavored to assist, although one feature they have undertaken has proved a failure—that is, the attempt to water cattle while they are in the cars. In justice to the companies that have

equipped their cars for this purpose, it must be admitted they have expended considerable sums in an attempt to furnish practical watering facilities, but the quantity supplied is usually insufficient unless considerable time is consumed, and a long train of stock to be liberally watered would occasion delays that could not be permitted.

Assuming that the watering of stock in transit is practically out of the question, it remains for the shipper to give his animals some water before loading them. Some shippers do not make a practice of doing this. They prefer to allow the thirst of the cattle to accumulate in anticipation of an increased fill at market. However, this custom is beset with risks that can not be controlled, such as long delays in transit, encountering heavy rains on the way followed by cold or snow, unfavorable weather at market, and arriving after the market has opened or at a late hour at night. All of these are factors that make the practice one of doubtful value, as it has been observed that in cases where these conditions obtain they tend to counteract the anticipated extra fill occasioned by the denial of water before loading. It appears to be the better plan to provide sufficient clean water and allow the cattle an opportunity to drink leisurely before loading them at the point of origin. Whether they shall be fed grain or hay before loading depends on how much and when they were last fed, the distance driven, the condition of the roads over which they traveled, and the weather.

These conditions of course do not apply to animals from the range. They apply especially to cattle that have been in feed lots. It was observed that when a shipper fed the usual quantity at the last feeding time on the farm before starting for the station, and drove leisurely so as not to warm the animals unnecessarily, that when they had cooled off in the station yards a light feed of oats, shelled corn, or hay was usually eaten without hesitation.

In agricultural districts where feed is plentiful it is the prevailing custom to fill the racks in the cars with hay, but in the range country this practice does not prevail to any extent on account of the scarcity of hay and the distance and inconvenience of getting it to the cars. In fact, on some roads it is not even permitted in the cars, because where certain kinds of soft coal are used in the engines there is too great a danger from flying sparks.

Many experienced shippers of feed-lot cattle contend that if the cattle are fed before loading the placing of hay in the racks is unnecessary. This contention is based on individual judgment and is not sustained by any array of facts. It was observed, however, that cattle do eat hay quite liberally, especially if it is a change from what they have been accustomed to in the feed lot. One shipper in Iowa usually fills the racks with sheaf oats, which he has saved for this pur-

pose. The oats were always consumed. An Illinois shipper bedded the cars deep with millet and filled the racks with choice alfalfa hay, the cattle having been fed all winter on clover and timothy hay.

It seems quite reasonable in view of the foregoing that when a change of feed is provided in the car racks it will be consumed. Moreover it has been observed that cattle are more contented and slightly less susceptible to excitement when they have been watered and fed liberally. If this be true, then it is fair to presume that when thus fortified for the journey the animals will experience the transfer from the farm to the market with the least shrinkage and arrive in the best physical condition possible under the conditions.

WEIGHING WARM AND COOL.

Throughout the feed-lots districts of the Middle West the railroads have provided platform scales at their principal stations, and it is a common practice among shippers to weigh their stock before loading in the cars for market. Many shippers keep an accurate account of the weights, and when the statement of the sale weights at market reaches them they are able at once to ascertain the amount of shrinkage experienced in the journey from point of origin to destination.

Some of the largest cattle raisers maintain platform scales on their farms, which enable them to keep strict account of the progress their animals are making during the feeding season. It was observed that animals which had been subjected to frequent weighing were more tractable and sustained less shrinkage in handling. Most of the farmers who have platform scales weigh their cattle just before starting for the railroad station or before the last feed is given. All of the weights thus taken are when the cattle are cool.

Where scales are provided it is the prevailing custom for cattle destined for market to be weighed promptly on arrival at the railroad station yards. The reason why the animals are weighed promptly on arrival is because it is more convenient for the shippers. The arrangement of the pens is such that it is easier to weigh on arrival and while the animals are warm than later on when they have cooled. It should be kept in mind that when the weights are taken on the farm previous to departure the cattle are cool, while the weights at the station are taken when the animals are warm. In this connection it is desired to call attention to the difference between weights taken when the animals are cool and when they are warm.

No extended investigation was made into the matter of how much cattle shrink in cooling. From the experience of veteran shippers it was learned that cattle weighing around 1,200 pounds would shrink

after an average trail from 15 to 20 pounds while cooling in the railroad pens. The distance traveled, the condition of the roads as to whether they were dry, muddy, or covered with snow, and the condition of the weather all have something to do with this loss of weight after arrival at the yards.

An experiment was made with one lot of yearlings, averaging slightly less than 1,000 pounds, that had been driven between 2 and 3 miles under normal conditions. Weights were taken promptly on arrival and again after 3 hours of rest in open pens without feed or water. In this instance the shrinkage while cooling amounted to 12½ pounds per head.

The fact that there is a shrinkage while cooling would appear to be an added reason for feeding and watering before loading when there is opportunity to do so. As before stated, it was observed that when feed was provided at the yards previous to loading it was generally consumed, with the result that the shrinkage was eliminated and the cattle fortified for the journey.

BREED NOT A FACTOR.

The investigation embraced all kinds of cattle common to the range and the feed lots. It included practically all of the beef breeds fattened on various feeds in different parts of the West and Middle West. Some of the animals were wild and difficult to manage; others were docile and quiet. Data were obtained on shipments ranging from 15 hours to several days in transit. Cattle acclimated to a rough environment may withstand more hardship and appear to be more rugged, but it was not ascertained that such cattle experienced less shrinkage in transit than others. True, the amount of shrinkage varied in individual shipments of the same breeds over like distances, but there were conditions experienced that accounted for the differences.

There was no particular difference noted between the cattle fattened on the ranges and those fattened on corn and hay. The shrinkage in transit and the fill at market of these two kinds, without respect to breed, was quite similar under like conditions. It was observed, however, that there was a difference in the fill at market of straight corn-fed cattle as compared with silage-fed cattle. It was also observed that the amount of shrinkage experienced by the animals fed on silage was somewhat more, as a rule, than cattle fattened on the range or on dry feed, but the increased fill at market was more than sufficient to offset the increased shrinkage of these animals, so much so that the records show a large percentage of increased net fill in favor of the silage feeding.

Inquiry was made of feeders in Iowa and Illinois as to whether salt was mixed in the silage with a view of creating an abnormal thirst that would reflect in the heavy fill at market, but all denied the use of salt, and further inquiry failed to locate a single instance where any attempt had been made to increase the natural thirst.

It was also noted that the breed was not a factor in this respect. Cattle fattened on the range or in the feed lots, and those fattened on pulp and on silage were not infrequently of the same breed and purchased from the same sources of supply. The question of the breed did not enter prominently into the transaction, and while shippers have their preferences of the breed they like best to feed, the records of the shipments do not reflect any difference in the shrinkage in transit or the fill at market that can be charged to breed.

DETAILS OF THE WORK.

MIXED RANGE CATTLE IN TRANSIT LESS THAN 36 HOURS.

The shipments in Table 10 were all from that section of the country known as the "Sand Hills," and consisted of western cattle that had been grazed and fattened in western Nebraska. There were 866 animals altogether, and all went to South Omaha. In general, the shipments were composed of cows, heifers, and steers varying in age from yearlings to 4-year-olds. Occasionally a shipment would have a few head of small calves.

The cattle were trailed distances varying from 1 to 30 miles. They were weighed while warm, or immediately on arrival at the railway pens, and then turned into a dry lot, where they remained until loaded into the cars.

With but three exceptions the shipments were made under normal weather conditions. The three exceptions mentioned were periods when there was a high wind and a temperature approaching zero. The figures obtained, however, do not indicate that the unusual weather was much of a factor in the shrinkage.

In the case of 23 head from Hyannis, Nebr., that refused to take a fill at market, an effort was made to get these animals to fill but without success, and they actually shrank about 184 pounds, or 8 pounds per head, while at market, although the weather conditions were normal and they arrived at a favorable hour in the morning.

The figures in Table 10 show considerable variation in the amount of fill obtained at market. There was but one shipment, above mentioned, that did not get a fill. The average fill for the 866 head was 28 pounds. The average shrinkage before the fill was 86 pounds and the average net shrinkage was 58 pounds.

TABLE 10.—*Mixed range cattle in transit less than 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
104	Alliance, Nebr....	30½	962	858	913	55	104	49	Four small calves in this shipment.
24	.....do.....	30½	1,166	1,037	1,107	70	129	59	Fed 2 bales of hay before loading.
75	.....do.....	36	888	813	853	40	75	35	All natives, trailed 11 miles.
33	.....do.....	25	767	699	714	15	68	53	All 3-year-old Angus.
45	.....do.....	22½	1,155	1,071	1,093	22	84	62	Three small calves in this shipment.
26	.....do.....	29	1,146	.....	1,101	.....	.....	45	Trailed 25 miles in extreme cold.
49	.....do.....	32	865	793	809	16	72	56	Trailed 20 miles; 39 old cows.
63	Hyannis, Nebr...	36	751	633	637	4	118	114	All natives, trailed 7 miles.
23	.....do.....	36	1,061	973	965	[1] — 8	88	96	These cattle refused to fill at market.
41	.....do.....	36	1,202	1,128	1,137	9	74	65	Utah cattle, grazed in Sand Hills.
23	.....do.....	33	1,022	941	964	23	81	58	Trailed 30 miles.
29	.....do.....	33	837	766	775	9	71	67	All natives, trailed 18 miles.
130	.....do.....	26	763	709	717	—8	54	46	All native yearlings, trailed 6 miles.
58	Whitman, Nebr..	29	899	830	844	14	69	55	On hay 1 week, trailed 13 miles.
55	.....do.....	29	967	882	895	13	85	72	Cows and steers, trailed 9 miles.
88	Lakeside, Nebr...	27	789	736	743	7	53	46	Trailed 9 miles in face of blizzard.
	Grand average.	30	909	823	851	28	86	58	

[1] Indicates loss instead of gain.

MIXED RANGE CATTLE IN TRANSIT FROM 36 TO 72 HOURS.

The shipments shown in Table 11 were all native cattle from ranges in Montana and Wyoming. The total number was 794. Many of these cattle were grazed and fattened on the Crow Indian Reservation in Montana. The shipments were composed of about one-half steers, the remainder being cows and heifers, with a few bulls and calves. None of the cattle were over 4 years of age. A few of the cars contained small calves, but there were not enough to make any appreciable difference in the performance of the animals in transit. With the exception of the small calves, all of the animals were trailed varying distances and loaded into the cars without feed or water in the railroad pens previous to loading. With but two exceptions all were unloaded, rested, fed, and watered at Alliance, Nebr.

All the shipments contained in the table except one were made under normal weather conditions and arrived at market under normal conditions. The one exception was from western Nebraska, where a

high wind and a temperature approaching zero prevailed at the time of loading.

It will be observed that the average fill at market is greater and the net shrinkage less in Table 11 than Table 10. This may be better understood when it is pointed out that the shipments in Table 11, with two exceptions, were unloaded, while the shipments in Table 10 were not unloaded from point of origin to market.

The grand averages of fill at market, total shrinkage, and net shrinkage for the average journey of 51 hours, as shown in Table 11, are 37 pounds of fill, 80 pounds total shrinkage, and 36 pounds net shrinkage, excluding the shipment of 153 head whose filled weights were not ascertained. It may be observed that the grand total shrinkage in Table 10 is 86 pounds for an average journey of 30 hours, while the grand total shrinkage in Table 11 is 6 pounds less for a period of 51 hours. Furthermore, the cattle on the longer journey took on a fill at market of 9 pounds per head more than those which reached their destination without unloading, while the net shrinkage was 22 pounds per head in favor of the longer haul.

It seems reasonable to infer from the results in Tables 10 and 11 that mixed range cattle shipped under the conditions named make a better showing at market when the journey has been long enough to necessitate a break for unloading and reloading.

TABLE 11.—*Mixed range cattle in transit from 36 to 72 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
52	Alliance, Nebr....	39	1,002	915	951	36	87	51	Cows and steers, 2-year-olds.
25	.....do.....	41	1,101	1,026	1,063	37	75	38	One small calf not included.
42	Big Horn, Mont..	46	1,120	1,068	1,094	31	57	26	Trailed 18 miles, all native steers.
100	Aberdeen, Mont..	54	966	876	932	56	90	34	Native cows, trailed 10 miles.
25	Parkman, Wyo...	54	979	933	980	47	46	+1	Four small calves not counted.
100	Little Horn, Mont.	46	1,072	977	1,020	43	95	52	Native cows and heifers, trailed 25 miles.
81	Sheridan, Wyo...	52	924	858	897	39	66	27	Loaded after fill at Sheridan.
153	.....do.....	55	767	657	.....	.....	110	.....	Filled weights not obtained.
106	Bridger, Wyo.....	58	953	896	920	24	57	33	Four head of calves included.
65	Little Horn, Mont.	47	1,193	1,134	1,166	32	59	27	Native 3 and 4 year old steers.
45	Benteen, Mont....	45	1,126	1,059	1,072	13	67	54	Southern steers, trailed 20 miles.
	Grand average.	51	978	[1] 898	992	37	80	[2] 36	

[1] Excluding the lot of 153 head whose filled weights were not ascertained, the grand average weight before fill is 955 pounds.

[2] Not including the 153 head whose fill was not ascertained.

MIXED RANGE CATTLE IN TRANSIT OVER 72 HOURS.

The shipments in Table 12 are all native cattle from ranges in Wyoming and Montana. The shipments were composed of 318 steers, 226 spayed heifers, and 151 head of mixed steers and cows, totaling 695 head. None of the steers or spayed heifers were over 4 years old. All of them had been grazed and fattened on the open range and trailed varying distances before loading. Most of them were trailed about 20 miles, and one shipment 50 miles, before loading.

Two of the shipments went to South Omaha, one being unloaded at Sheridan, Wyo., and delayed 20 hours because of a washout, and the cattle unloaded again at Alliance and Lincoln, Nebr.; the other was unloaded at Sheridan, Wyo., and Alliance, Nebr. The remaining shipments were consigned to Chicago and were unloaded at Alliance, Nebr., and Creston, Iowa.

All of the shipments were made and all arrived at market under normal weather conditions. Some of the cattle were confined in pens where the mud was deep at one or two of the unloading stations, but only one shipment encountered a hard rainstorm at any unloading point. So that, so far as weather was concerned on the long hauls, it was quite generally favorable throughout the journey. Another favorable factor was the arrival at market at a convenient hour. All but one shipment of two carloads arrived after daylight and in time for the morning market.

Comparing Table 12 with the preceding Tables 10 and 11, it will be observed that the grand averages for a haul consuming 75 hours are the same as regards shrinkage during the journey as for an average period of 51 hours and 6 pounds less than for an average period of 30 hours. The net shrinkage is greatest in the short haul and least in Table 11 (51 hours), the figures for the latter being 22 pounds less than for the haul of 30 hours.

The amount of fill at market is 1 pound less for the long haul of 75 hours as compared with the short haul of 30 hours, but the latter is 9 pounds less than the average for the haul of 51 hours.

TABLE 12.—*Mixed range cattle in transit over 72 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
44	Big Horn, Mont..	75	1,207	1,108	1,110	2	99	97	Native and southern steers.
51	Bemeen, Mont....	74	1,043	958	987	29	85	56	Spayed heifers, trailed 20 miles.
75	Little Horn, Mont.	77	1,033	984	1,012	28	49	21	Do.
92	Sheridan, Wyo...	74	772	720	760	40	52	12	Mixed cattle, trailed 18 miles.
122	Aberdeen, Mont..	80½	1,083	987	1,015	28	96	68	Heifers (100) and steers (22), trailed 10 miles.
125	Little Horn, Mont.	74	1,085	1,000	1,036	36	85	49	3-year-old heifers, trailed 25 miles.
54	Cody, Wyo.....	101	1,000	910	936	26	90	64	Native cows and steers, trailed 10 miles.
132	Tyndell, Wyo....	[1] 61	1,055	968	984	16	87	71	Texas steers, trailed about 50 miles.
	Grand average.	75	1,030	950	977	27	80	53	

[1] Washout caused 20 hours' delay, which is not included in the 61 hours. During this elapsed time the cattle were in pens at Sheridan, Wyo., and fed a short ration.

MIXED CORN-FED CATTLE IN TRANSIT 26 HOURS OR LESS.

The shipments shown in Table 13 are composed in the main of native cattle raised on the farms of Iowa. The loads were made up mostly of steers, from yearlings to 3-year-olds, the other animals consisting of 8 cows, 3 heifers, and 1 bull, making a total of 278. One shipment of 49 head of 2 and 3 year old western Herefords represented the only lot not composed entirely of cattle native to the State. The shipments were trailed varying distances of from one-half to six miles.

The manner of feeding was very similar in all cases. The feeds consisted of corn, hay, and corn fodder, with some oil meal. Most of the cattle were weighed while warm soon after arriving at the station pens. The practice of bedding the cars with hay or straw and putting liberal quantities of hay in the car racks was generally observed.

With one exception none of the shipments encountered any stress of weather in reaching the loading stations or market. Two of the shipments were made at a time when the temperature was near zero, but there was no storm and the snow was not deep.

It may be noted later on that other shipments composed of the same class of animals and in some instances from the same points of origin will show a greater length of time in transit. This difference in time was caused in such cases by weather conditions which necessitated delays, the snow and intense cold making the movement of stock trains more difficult.

TABLE 13.—*Mixed corn-fed cattle in transit 26 hours or less.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
57	West Side, Iowa..	25¾	1,236	1,119	1,158	39	117	78	Trailed less than one-half mile.
57	Beaver, Iowa.....	26	957	891	930	39	66	27	Including 7 cows. Fed 5 bushels of oats before loading.
72	Boone, Iowa.....	23	1,390	1,333	1,343	10	59	49	Snow-bound, shipment unloaded twice.
22	Beaver, Iowa.....	23¾	1,058	990	1,038	48	68	20	Including 1 bull and 1 cow. Full of feed when loaded.
21	Ogden, Iowa.....	23¾	1,096	1,001	1,032	31	95	64	Including 3 heifers. Full of hay when loaded.
49	Scranton, Iowa...	23	1,373	1,306	1,310	4	67	63	No hay in car racks.
	Grand average.	24	1,218	1,142	1,167	25	76	51	

MIXED CORN-FED CATTLE IN TRANSIT 26 TO 30 HOURS.

The shipments shown in Table 14 were made in the main during severe weather conditions. There are in all 38 shipments, involving 1,210 animals. They constitute typical winter shipments when cattle are exposed to the elements. They also embrace extreme conditions in driving from farm to station, some shipments being driven during raging blizzards with the temperature down to 18 degrees below zero and the cattle traveling through deep snow that caused them to flounder about and become all but hopelessly stalled.

The weather conditions are an interesting factor in this table owing to their unusual nature. There were 9 shipments made when the temperature was at zero; 7 shipments when the weather was cold and clear; 6 shipments when the temperature registered 30 degrees below zero; 4 shipments in a typical western blizzard with the temperature from 15 to 18 degrees below zero; 8 shipments when the sun was shining and the snow thawing; and 4 shipments when it was cold and snowing steadily.

Six of the 38 shipments were western cattle, the remainder being native. Only 2 shipments were yearlings, 9 shipments were 2-year-olds; 18 shipments were 3-year-olds, and 9 shipments were of mixed ages.

The average distance trailed was 4½ miles, and none came a greater distance than 10 miles. Ten of the shipments were not fed before starting for the station, while 28 were fed their regular feed before the journey was begun. An unusual feature encountered was the condition of the roads over which the animals traveled from the

farm to the station. None of the shipments traveled over bare roads. The condition ranged from soft slushy snow to snow 3 feet deep, badly drifted, and covered with a hard frozen crust. This sort of footing coupled with a stiff, keen, cutting wind made travel slow and laborious.

But 9 of the shipments were cool at the time of weighing. The 29 that were weighed while warm indicate the prevailing custom to weigh as soon as the cattle reach the scales at the station. It is a fact quite well known that cattle shrink while cooling. Just how much this shrinkage is could not be accurately established owing to lack of facilities and limited time. However, a few instances where weights were taken before and after the cattle had cooled showed from 15 to 20 pounds shrinkage in steers weighing 1,200 pounds.

The average time the different shipments in the table were on full feed was 100 days. The feed in nearly every instance was corn, hay, and oil meal. Considerable rough feed, such as stalks and straw, was fed. The hay was generally clover or timothy. There was also some alfalfa meal fed. In only 3 shipments was there any stock feed fed.

Twenty-one of the shipments arrived at market during the night or early morning before daylight, the remaining 17 shipments reached their destination between daylight and noon.

Owing to the scarcity of scales on the farms, there was but little opportunity to secure the shrinkage of the cattle in traveling from the farm to the station. In only two instances was this shrinkage secured. One shipment of 3-year-old native steers driven 10 miles through soft snow, not fed before starting and weighed cool on the farm and warm at the station, shrank 19 pounds per head from farm to station. This lot had been on full feed for 125 days. Another lot of 3-year-old native steers that had been on full feed for 90 days, trailed 5 miles through 30 inches of snow in a zero temperature, weighed cool on the farm before starting and warm at the station, shrank 21 pounds each from the farm to the station.

The data in the table include a number of typical instances of the effect of extreme weather conditions on the shrinkage of cattle in transit to market. This is particularly noticeable in the case of the six shipments from West Side, Iowa, where the animals were driven distances varying from 3 to 7 miles through deep snow when the temperature was reported 30 degrees below zero. On some of the roads the snow was badly drifted, so much so that in one case the animals became stalled frequently and experienced much difficulty in extricating themselves. The cattle in these 6 shipments averaged 1,270 pounds per head at the shipping station, 1,169 pounds on arrival

at market, and 1,202 pounds each after the fill at market. These figures give an average fill of 33 pounds per head, a total shrinkage of 101 pounds, and a net shrinkage per head of 68 pounds. This figure, it may be noted, is 17 pounds higher than the average for all the shipments.

It is hardly probable that these same extreme conditions will be met with frequently. Taken as a whole, the shipments in the table are rather beyond the average with respect to adverse weather conditions. They are, however, useful in showing the performance of cattle under stress of weather and other extreme conditions.

TABLE 14.—*Mixed corn-fed cattle in transit 26 to 30 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
21	West Side, Iowa..	26½	1,196	1,097	1,137	40	99	59	Two small calves included.
34	Dunlap, Iowa....	28	1,580	1,466	1,519	53	114	61	Trailed 4 miles through deep snow.
36	.....do.....	28	1,330	1,252	1,287	35	78	43	Weighed cool before loading.
18	.....do.....	28	1,494	1,392	1,413	21	102	81	Trailed 5 miles through deep snow.
20	.....do.....	30	1,279	1,139	1,185	46	140	94	Weighed cool.
90	.....do.....	28	1,409	1,337	1,369	32	72	40	Trailed 10 miles through deep snow.
61	.....do.....	30	1,085	1,017	1,052	35	68	33	Weighed cool.
25	.....do.....	30	957	858	905	47	99	52	Fed corn, oats, and hay before loading.
18	.....do.....	30	1,293	1,207	1,273	66	86	20	All 3-year-old western steers.
17	.....do.....	30	1,484	1,410	1,453	43	74	31	Trailed 10 miles, weighed cool.
20	.....do.....	30	1,232	1,190	1,215	25	42	17	Do.
37	.....do.....	28	1,171	1,108	1,140	32	63	31	Western steers, trailed 5 miles.
38	West Side, Iowa..	29½	1,272	1,170	1,199	29	102	73	Fed hay before loading.
20	.....do.....	29½	1,287	1,163	1,214	51	124	73	Fed hay after weighing.
37	.....do.....	29	1,254	1,163	1,199	36	91	55	Trailed 3 miles, deep snow, 30° below.
21	.....do.....	29	1,164	1,086	1,115	29	78	49	Trailed 5 miles, deep snow, 30° below.
19	.....do.....	29	1,332	1,215	1,240	25	117	92	Trailed 3½ miles, deep snow, 30° below.
35	.....do.....	29	1,451	1,291	1,328	37	160	123	Trailed 5 miles, deep snow, 30° below.
37	.....do.....	29	1,210	1,129	1,174	45	81	36	Trailed 7 miles, deep snow, 30° below.
37	.....do.....	29	1,214	1,123	1,152	29	91	62	Do.
20	.....do.....	26½	1,152	992	1,102	110	160	50	Trailed 5 miles, hay in car.
18	.....do.....	26½	1,375	1,254	1,294	40	121	81	Trailed 7 miles, hay in car.
36	.....do.....	26½	1,376	1,282	1,331	49	94	45	Trailed 5 miles, hay in car.
42	.....do.....	26½	1,137	1,070	1,081	11	67	56	Trailed 4 miles, sheaf oats in car.

TABLE 14.—*Mixed corn-fed cattle in transit 26 to 30 hours*—Continued.

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
42	Denison, Iowa....	29	1,208	1,137	1,163	26	71	45	Trailed 7 miles, blizzard, 18° below.
22	.....do.....	29	1,197	1,137	1,163	26	60	34	Trailed 5 miles, blizzard, 18° below.
56	.....do.....	27	810	725	749	24	85	61	One small calf included.
34	.....do.....	27	1,358	1,265	1,313	48	93	45	Trailed 6 miles, weighed cool.
20	Breda, Iowa.....	26½	1,196	1,117	1,158	41	79	38	Trailed 7 miles, hay in car.
62	Vail, Iowa.....	26½	1,069	983	1,022	39	86	47	All native 2-year-olds.
45	Ogden, Iowa.....	27	1,016	933	969	36	83	47	Deep snow, high wind, 15° below.
31	.....do.....	27	765	704	734	30	61	31	Trailed 5 miles through deep snow.
24	Grand Junction, Iowa.	27	1,173	1,101	1,138	37	72	35	Fed hay before loading.
20	.....do.....	27	1,368	1,239	1,272	33	129	96	Fed hay and oats before loading.
18	Boone, Iowa.....	27	1,224	1,178	1,215	37	46	9	One small calf included.
20	Elgin, Iowa.....	27¾	1,197	1,121	1,151	30	76	46	Trailed 5 miles over hard snow.
36	Woodbine, Iowa..	29	1,383	1,308	1,331	23	75	52	All native steers.
23	Jefferson, Iowa...	27	865	807	831	24	58	34	Full of hay and corn before loading.
	Grand average.	28	1,213	1,127	1,163	36	87	51	

MIXED CORN-FED CATTLE IN TRANSIT 30 TO 36 HOURS.

The shipments shown in Table 15 were made from the same State and in some instances from the same points of origin as those contained in Table 14. They were not, however, exposed to the extreme weather conditions, and they come more nearly under what might be considered normal winter weather conditions. There are 19 shipments in all, with a total of 529 animals.

Of the total shipments 9 were made when the weather was clear and thawing, 7 when the weather was clear and freezing, 1 when it was snowing, 1 when there was a blizzard with the temperature about 18 degrees below zero, and 1 shipment when the weather was clear and the temperature about zero. Nor did the cattle meet with the extremes in the matter of roads as those in Table 14. Thirteen of the shipments came in over roads that were soft, such as soft snow, slush, or soft mud. Only 6 shipments traveled roads that were covered with frozen snow. The greatest distance trailed was 10 miles and the shortest 2 miles, the average distance being 6 miles.

The average length of time the different lots of cattle in this table were fed was 110 days. The feeding was very similar to that of the

cattle in the previous table, corn, hay, and oilcake meal being the main feeds. Practically an equal number of shipments arrived at the market before and after daylight, 9 arriving after and 10 before.

A feature worthy of passing mention is the shrinkage of 21 head of native yearling steers that had been driven 2 miles through soft snow to the station and weighed immediately upon arrival. Three and one-half hours later they were weighed again after they had cooled and it was found they had shrunk 12½ pounds each. They averaged when weighed warm 955 pounds.

All of the animals composing Table 15 were natives except one shipment of 39 head of 3-year-old western steers. Of the 19 shipments in the table, 16 were weighed warm upon arrival at the station and 3 were cool at the time of weighing.

TABLE 15.—*Mixed corn-fed cattle in transit 30 to 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
40	Vail, Iowa	30¾	1,136	1,052	1,100	48	84	36	Fed 3 bushels of oats before loading.
35	Marcus, Iowa	36	1,032	969	1,005	36	63	27	Trailed 6 miles, hay in car.
19	Kirkman, Iowa	33	1,130	1,072	1,097	25	58	33	Trailed 5 miles over soft mud roads.
23	do	33	968	883	931	48	85	37	Do.
40	Audubon, Iowa	33	1,174	1,105	1,155	50	69	19	Trailed 10 miles, no feed before loading.
21	Kirkman, Iowa	34	1,063	1,001	1,045	44	62	18	Trailed 6 miles, no feed before loading.
60	do	34	1,296	1,213	1,258	45	83	38	All 3-year-old native steers.
22	do	34	1,031	973	998	25	58	33	Watered before loading.
29	Harlan, Iowa	34	697	636	658	23	61	38	Trailed 8 miles over soft roads.
19	Marcus, Iowa	35	1,084	1,007	1,046	39	77	38	Trailed 9 miles.
38	Halbur, Iowa	35	1,149	1,051	1,088	37	98	61	Fed oats before loading.
20	Schleswig, Iowa	34	577	530	549	19	47	28	Weighed cool.
9	Halbur, Iowa	35	1,133	1,058	1,110	52	75	23	Mixed with a car of hogs.
20	do	35	1,156	1,057	1,083	26	99	73	Trailed 3½ miles through soft snow.
21	Arion, Iowa	35	955	866	904	38	89	51	Shrunk 12½ pounds cooling at station.
40	Audubon, Iowa	35	1,392	1,264	1,319	55	128	73	All 3-year-old native steers.
23	Denison, Iowa	32½	1,111	1,024	1,060	36	87	51	Trailed 5 miles, blizzard, 18° below.
22	Logan, Iowa	36	1,307	1,185	1,219	34	122	88	Weighed full, loaded empty.
28	Marcus, Iowa	36	619	535	564	29	84	55	6 calves included.
	Grand average	34	1,082	999	1,037	38	83	45	

SILAGE-FED CATTLE IN TRANSIT LESS THAN 20 HOURS.

The shipments shown in Table 16 were made under normal conditions with one exception. This was the shipment of 21 head from Whitehall, Ill., which arrived at East St. Louis late in the afternoon. During the night a heavy rainstorm set in, and as the cattle were confined in open pens they were thoroughly drenched. The following morning the weather turned quite cool and the animals refused to drink. This resulted in the extremely small fill of 6 pounds per head and caused the net shrinkage to be considerably more than that of any other shipment recorded in the table. There were seven shipments in all, totaling 397 head.

The shipment of 107 head from Marshalltown, Iowa, shows a result which is out of the ordinary, as the final weights of the cattle were heavier than when they were placed on the cars. As shown in the table, the fill at market replaced the shrinkage in transit and 7 pounds more. All of the animals were 2-year-old western steers that had been fed ground oats the night previous to shipment, but were given no water. The following morning they were brought to the station in two lots, one lot being trailed 2 miles and the other 4 miles. These cattle had been fed 75 days on canning-factory silage, corn, hay, and cottonseed meal. Hay was put in the car racks before loading.

Particular attention is called to the grand average net shrinkage as shown in this table, since it is considerably smaller than the average in the other tables. In fact the difference is so marked that some explanation should be given. The very low average is due to the previously mentioned shipment of 107 head which gained 7 pounds at market. With this shipment excluded the average would be raised to 35 pounds.

In this connection it may be stated that four other shipments made under similar environment and covering an average length of 15½ hours in transit show a grand average net shrinkage of 49 pounds. These four shipments are not included in the table because the fill at market was not ascertained. There were 155 animals in the shipments, and while the net shrinkage averages considerably higher than that of the 397 cattle in the table, we are unable to advance any reasons for the increased shrinkage, owing to the incompleteness of the returns. However, if we combine the two averages we get a net shrinkage of 30 pounds for the entire 552 animals, and this would seem to be a fair average for silage-fed cattle in transit 16 hours.

TABLE 16.—*Silage-fed cattle in transit less than 20 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
44	Abingdon, Ill	15	1,212	1,166	1,195	29	46	17	No hay in cars.
33	.....do.....	12½	1,375	1,281	1,324	43	94	51	Not fed or watered after weighing.
40	Orleans, Ill.....	19	1,363	1,268	1,337	69	95	26	Native 4-year-olds, weighed cool.
21	.....do.....	19	1,110	1,036	1,095	59	74	15	Native 3-year-olds, weighed cool.
107	Marshalltown, Iowa.	19	1,070	1,024	1,077	53	46	[1]7	Western 2-year-olds, gained 7 pounds.
21	Whitehall, Ill.....	5	1,408	1,335	1,341	6	73	67	Cold and rain at market.
131	Letts, Iowa.....	15½	1,297	1,210	1,260	50	87	37	Western 3-year old steers.
	Grand average.	16	1,232	1,161	1,209	48	71	[2]23	

[1] Gain. [2] The average net shrinkage raised to 30 pounds (see text).

SILAGE-FED CATTLE IN TRANSIT MORE THAN 20 HOURS.

All of the shipments shown in Table 17 were made under normal weather conditions. The final results at market are worthy of special attention. One feature of significance is the fill at market. The grand average of 60 pounds is considerably more than any of the fills recorded in the other tables, regardless of the feeding methods. There are 11 shipments in the table, with a total of 438 animals.

In connection with the unusually large fill in this table attention is called to the shipment of 50 head from Orleans, Ill., which had the maximum fill of 97 pounds. The record of this shipment shows the cattle to have been 3 and 4 year old western steers on full feed 217 days. They were fed corn and hay the night before shipping and the water turned off. The following morning they were weighed and driven 1 mile to the station, where they were kept in open pens without feed or water until shortly before noon, when they were loaded. The train left at noon and reached market at 9.15 the next morning. A liberal quantity of alfalfa hay was put in the car racks, otherwise the cattle had nothing to eat or drink for 24 hours. It will be observed that the gross shrinkage from farm to market was 105 pounds per head, but the unusual fill at market of 97 pounds reduced the net shrinkage to 8 pounds.

Of no less interest is the heavy shrinkage shown in a number of other shipments. There are four of over 100 pounds and three of over 90 pounds. The fact that the shrinkage is in most cases offset by a good fill at market very materially reduces the net shrinkage;

thus one shipment has but 7 pounds, one 8 pounds, and three others are under 30 pounds.

The chief point of value to be gained in this table is found in the fill at market. As compared with other methods of feeding, silage-fattened cattle as a rule are good "drinkers" at market, and usually take on a good fill. This feature is responsible for the very light net shrinkage shown in the grand averages.

It may be of interest to compare the net shrinkage in this table with that of four other shipments of silage-fed cattle which are not included because of incomplete data. These four shipments, all from Iowa, were made under normal weather conditions and have an average net shrinkage of 45 pounds for an average journey of 27 hours. If the 53 cattle comprised in these shipments are averaged with those in the table, the net shrinkage for all would approximate 34 pounds. This figure would no doubt better represent the average net shrinkage in silage-fed cattle in transit 26 hours than the slightly lower figure in the table.

TABLE 17.—*Silage-fed cattle in transit more than 20 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination.		Average fill at market.	Average shrinkage.		Remarks.
				Before fill.	After fill.		Before fill.	After fill.	
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
53	Corwith, Iowa	27	1,167	1,083	1,140	57	84	27	Not trailed, weighed cool.
59	Luverne, Iowa	28	1,196	1,103	1,167	64	93	29	Trailed 7 miles through hard rain.
18	Dallas Center, Iowa.	34	1,353	1,218	1,278	60	135	75	Weighed cool, no hay in car.
39	do	34	1,198	1,077	1,127	50	121	71	Weighed full and cool at station.
71	Clayton, Ill.	23	653	597	646	49	56	7	Weighed cool, no hay in car.
39	Elgin, Iowa	23	1,227	1,128	1,181	53	99	46	Not trailed, weighed cool.
43	do	23	1,025	930	987	57	95	38	Weighed full at station.
28	Harper, Iowa	23	1,183	1,109	1,158	49	74	25	Native 2-year-old steers.
21	Keota, Iowa	22	1,258	1,130	1,215	85	128	43	Trailed 1 mile, loaded full.
17	Carthage, Ill.	20	955	875	902	27	80	53	Weighed cool and full at home.
50	Orleans, Ill.	21	1,473	1,368	1,465	97	105	8	Weighed cool, trailed 1 mile.
	Grand average.	25½	1,121	1,029	1,089	60	92	[1]32	

[1] The average net shrinkage raised to 34 pounds (see text).

BEET-PULP FED CATTLE.

The data concerning the shrinkage in transit of cattle fed principally on beet pulp are not as complete as those given in the preceding tables for the other market classes of cattle. However, through the courtesy of the Great Western Sugar Co., of Denver,

we are able to present some details, including the net shrinkage and methods of feeding, for upward of 3,600 cattle which were fed and marketed in 1911 and 1912. The great majority of these cattle were fed and shipped at several points in Colorado, the remainder being shipped from Billings, Mont. The details will be found in Table 18, which follows a brief discussion of the principal features bearing upon the shipping, shrinkage, etc., of these cattle.

TIME AND DISTANCE TO MARKET.

The distance traveled to market by the Colorado cattle was approximately as follows: To Omaha, 450 miles; St. Joseph, 520 miles; Kansas City, 580 miles; St. Louis, 825 miles; Chicago, 1,000 miles. The Montana cattle traveled slightly over 1,300 miles. The probable time consumed in the journey from Colorado to the various markets would be as follows: Omaha, 38 hours; St. Joseph, 57 hours; Kansas City, 60 hours; St. Louis, 70 hours; Chicago, 72 hours. The time in transit from Billings, Mont., to Chicago was 87 hours by the shipments that were unloaded at Glendive and Staples, and 119 hours by those unloaded at Mandan and St. Paul.

SHRINKAGE IN TRANSIT.

It will be noted that the average shrinkage in transit increased with the length of the journey, except in the case of the cattle marketed at Omaha, of which there was only a single shipment—not enough to form a reliable estimate. Thus the average shrinkage to St. Joseph, including the 1912 shipments, was 36 pounds per head; to Kansas City (1911 and 1912), 55½ pounds; to St. Louis, 68 pounds; and to Chicago (all shipments), 88½ pounds.

FILL AT MARKET.

No record was kept of the fill at market except in the case of two of the shipments from Billings, Mont. In one case 20 head filled 11 pounds each; in the other 190 head filled 26 pounds each; the average for both shipments being 24½ pounds per head.

SHRINKAGE BEFORE LOADING.

An interesting point in connection with these pulp-fed cattle is the shrinkage which occurs just previous to loading them for market. It is the custom to take the cattle off the regular ration and give them nothing but hay the day before loading, and no water for half a day. We have a record of what this shrinkage amounts to in the case of two lots, which, although the results differ widely, will give some indication of what it is.

One lot of 88 head fed at Brush, Colo., when taken off the pulp ration at 10 p. m. weighed 112,740 pounds and at 8.45 p. m. the

following day when loaded weighed 106,745 pounds, the total shrinkage being 5,995 pounds and the average shrinkage 68 pounds.

Another lot of 92 head at Fort Morgan, Colo., weighed 111,090 pounds at the end of the feeding and 108,150 pounds at loading time, the total shrinkage in this case being 2,940 pounds and the average shrinkage 32 pounds.

METHODS OF FEEDING.

A line on the feeding methods with pulp cattle may be had from the following instances of rations fed, which have been kindly furnished.

The average daily ration of 3-year-old southern steers fattened at Sterling, Colo., in 1911, average time on feed 179 days, was as follows:

	Pounds.
Beet pulp	89.1
Alfalfa hay	11.4
Molasses-alfalfa hay	4.2
Molasses	2.0
Cottonseed cake	1.8
Ground corn	2.3
Straw	.56
Sorghum	.23
Salt	.004

The average daily ration of a shipment of 88 head of 3-year-old steers, fed at Brush, Colo., and marketed in February, 1912, after being on feed 110 days, was as below:

	Pounds.
Beet pulp	90–100
Alfalfa hay	12
Molasses-alfalfa hay	6
Cottonseed cake	1½
Ground corn	3

TABLE 18.—*Beet-pulp-fed cattle in transit from 2 to 5 days.*

Date of shipment.	Shipping point.	Unloading station.	Market.	Number of cattle.	Days on feed.	Average net shrinkage.
						Lbs.
1911	Brush, Colo	Lincoln	Omaha	56	[1]	66
	Sterling, Colo	do	St. Joseph	63	146	60.3
	do	do	do	57	146	18.5
	do	do	do	124	160	[2] 5.2
	do	do	do	96	209	85.2
1911	do	do	do	40	226	45
	Brush, Colo	do	do	83	[1]	31
	do	do	do	42	[1]	55
	do	do	do	111	[1]	50
	do	do	do	52	[1]	83
Average for St. Joseph, 1911.					170	59

[1] Figures not available for separate shipments, but the average number of days on feed for all the shipments from Brush, Colo., was 164.

[2] This shipment gained in weight after the fill at market. The cattle were taken off pulp 22 hours before shipping and put on dry feed. They shrank 68 pounds per head during this time.

TABLE 18.—*Beet-pulp-fed cattle in transit from 2 to 5 days*—Continued.

Date of shipment.	Shipping point.	Unloading station.	Market.	Number of cattle.	Days on feed.	Average net shrinkage.
						Lbs.
1911	Sterling, Colo.	St. Joseph	Kansas City	63	146	53.3
	do	do	do	57	146	58.1
	do	do	do	54	146½	6.7
	do	do	do	36	146½	30.4
	do	do	do	96	210	88.3
	Brush, Colo.	do	do	111	(1)	55
	do	do	do	52	(1)	82
Average for Kansas City, 1911.					165	57.5
1911	Sterling, Colo.	Lincoln and St. Joseph.	St. Louis	102	189	84.4
	Brush, Colo.	do	do	125	(1)	48
	do	do	do	111	(1)	58
	do	do	do	151	(1)	81
Average for St. Louis, 1911.					171	68
1911	Sterling, Colo.	Lincoln and Montgomery.	Chicago	103	146	14.9
	do	do	do	102	189	132
	Brush, Colo.	do	do	75	(1)	100
	do	do	do	75	(1)	71
	do	do	do	64	(1)	83
	do	do	do	64	(1)	112
Average for Chicago, 1911.					165	83.4
Jan. 20, 1912	Sterling, Colo.	Lincoln	St. Joseph	87	.....	38
Jan. 26, 1912	do	do	do	98	.....	17
Feb. 5, 1912	Brush, Colo.	do	do	88	110	2.6
Feb. 10, 1912	Fort Morgan, Colo.	do	do	88	.....	[2]3.9
Do	Sterling, Colo.	do	do	88	.....	28
Feb. 23, 1912	Fort Morgan, Colo.	do	do	92	125	16
May 13, 1912	do	do	do	68	225	65
May 18, 1912	do	do	do	84	230	30
Average for St. Joseph, 1912.					.....	22.5
May 13, 1912	Fort Morgan, Colo.	Lincoln	Kansas City	68	225	42
Jan. 30, 1912	Billings, Mont.	Mandan and St. Paul.	Chicago	36	104	120
Do	do	do	do	275	104	82
Do	do	do	do	86	104	122
Feb. 7, 1912	do	Glendive and Staples.	do	20	164	79
Do	do	do	do	90	164	99
Do	do	do	do	190	164	85
Average for Chicago, 1912.					.....	92

[1] Figures not available for separate shipments, but the average number of days on feed for all the shipments from Brush, Colo., was 164.

[2] This shipment gained in weight after the fill at market. The cattle were taken off pulp 22 hours before shipping and put on dry feed. They shrank 68 pounds per head during this time.

SUMMARY OF SEASON'S WORK.

The summary of all of the tables in Part II is shown in Table 19. The gross shrinkage, or the shrinkage in transit, is seen to vary greatly with all cattle regardless of which class they are in. The greatest gross shrinkage occurred with the feed-lot cattle, although the difference between them and the range cattle in this respect was very slight. The highest as well as the lowest loss of weight in

transit was experienced by the cattle fed on silage. In general it may be seen that the shrinkage in transit was very uniform for all classes of the cattle.

Contrary to the universal opinion that range cattle do not fill as well at market as finished cattle, it is to be noticed that there is little difference between the fill taken by the grass cattle and the corn-fed cattle. The range cattle, however, had the advantage in that the majority of them went to market in the early fall, while the weather was good and conditions were favorable for a good fill. This was not the case with the fed cattle, which experienced some very severe weather at market.

An important point shown in the table is the large fill taken by the cattle which were fattened on silage. They showed the greatest gross shrinkage, but the fill taken was so large that the net shrinkage on these cattle was the least of all.

The net shrinkage on all the cattle was very uniform. The figures show that as a rule the greatest shrinkage occurs during the first portion of the journey. The two exceptions to this are the range cattle in transit from 36 to 72 hours and the corn-fed cattle in transit from 30 to 36 hours.

TABLE 19.—*Summary of northwestern work of 1911–12.*

Class.	Number of shipments.	Number of cattle.	Average weight at origin.	Gross shrinkage.		Fill at market.		Net shrinkage.		Ratio of net shrinkage to live weight at origin.
				Range.	Average.	Range.	Average.	Range.	Average.	
			Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*
Mixed range cattle in transit less than 36 hours	16	866	909	53–129	86	−8– 70	28	35–114	58	6.38
Mixed range cattle in transit 36–72 hours	11	794	978	46–110	80	13– 56	[1] 37	+1– 54	[1] 36	3.68
Mixed range cattle in transit over 72 hours	8	695	1,030	49– 99	80	2– 40	27	12– 97	53	5.09
Mixed corn-fed cattle in transit less than 26 hours	6	278	1,218	59–117	76	4– 48	25	20– 78	51	4.19
Mixed corn-fed cattle in transit 26–30 hours	38	1,209	1,214	42–160	87	11–110	36	9–123	51	4.20
Mixed corn-fed cattle in transit 30–36 hours	19	527	1,086	50–128	84	20– 55	39	18– 88	45	4.15
Silage-fed cattle in transit less than 20 hours	7	397	1,232	46– 95	71	6– 69	48	+7– 67	[2] 23	1.87
Silage-fed cattle in transit over 20 hours	11	438	1,121	56–135	92	27– 97	60	7– 75	32	2.85
Beet-pulp fed cattle in transit from 2 to 5 days	42	3,623	.....	.....	.....	.....	.....	.....	61	.....

[1] Not including 153 head for which fill was not ascertained.

[2] This average is unusually low because of one shipment of 107 head which actually gained 7 pounds per head after the fill at market. If this shipment is left out the average net shrinkage of the remaining 290 is raised to 30 pounds.

CONCLUSIONS.

THE SHRINKAGE IN TRANSIT.

Cattle allowed to cool in the station pens at point of origin and given a moderate allowance of water and a light feed of hay before loading appear to endure the journey with less shrinkage and take

on a more natural fill at market than animals denied both water and feed before loading. If cattle are not fed or watered before loading and unusual delays are experienced they may arrive at market so tired from the jolts and long standing as to prefer lying down to eating or drinking, or so hungry and thirsty that they will eat and drink so much at market as to attract attention.

THE FILL AT MARKET.

The best that can be expected at market is a natural fill. All plans and preparations made in anticipation of a natural fill may be upset, however, by conditions encountered in transit or upon arrival. The custom that now obtains in the market of allowing cattle to eat or drink until sold provides the shipper every opportunity to have his animals in the best physical condition. There are no restrictions placed by the stockyards management as to how much or what he shall feed, or when he shall water his animals. The shipper is permitted to exercise his own judgment in the matter, so that misfortunes encountered in transit or on arrival may in a measure be overcome by exercising good management at market.

WEIGHING BEFORE LOADING.

Where opportunity will permit and scales are available it is considered advisable to weigh animals before loading. There are two very good reasons to support this suggestion.

1. The weights taken before loading provide the shipper with the means of knowing exactly what the shrinkage has been from the farm to the market. Furthermore, if he has fattened the animals the weights before loading will also supply him the information needed to determine the progress of his feeding.

2. In the event that his shipment meets with disaster in transit the before-loading weights supply an intelligent basis for the recovery of his loss, and the same applies in case his shipment has encountered prolonged delays resulting in excessive shrinkage in transit.

Many of the larger railroads traversing the cattle-producing sections, with the exception of the western range country, have platform scales in the station pens at the more important loading points on their lines. These scales are at the disposal of the shipper, and no restrictions are placed on their use in connection with the shipment of live stock. It is suggested in this connection that shippers who know in advance of the approximate time of their loading should personally ascertain if the scales are in good working condition.

III. NORTHWESTERN AND SOUTHWESTERN SHRINKAGE WORK OF 1911.

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INTRODUCTION.

The beef-cattle industry of the Northwest is still one of importance and contributes extensively to the supply of cattle sold on the Chicago, St. Paul, and Omaha markets. It is true that there are not so many cattle raised and shipped from that section as there were ten years ago. The invasion of the large grain farmers, the small farmers, the homesteaders or "squatters" and the sheepmen have been a series of blows which have been felt very materially by the cattle industry. There are some people, even some of the older cattlemen, who seem to see the doom to their kind and death to their industry. In a way they are right. The "old timers" must go, and with them their traditions and their methods. The ever-increasing values of some of the lands of the Dakotas, Montana, Wyoming, Colorado, and Nebraska, due to their settlement by farmers and their use for the production of grain, are naturally raising the valuation of the grazing lands, and thus raising the cost of producing beef under range conditions. The large ranges of the Northwest are being cut up into small farms wherever practicable, and draft animals are replacing the tough and blocky ponies of that section. The many men with very few cows are taking the land from the few men with many cows.

Although the number of cattle shipped from these ranges during the past year has dropped to less than half the amount of six years ago, it does not naturally follow that the decrease will continue until this section is no longer a cattle country. It always will produce a large number of cattle, since there are immense areas of this land which can be used for grazing only. Some of it is not suitable for farming, and on these tracts cattle and sheep will abound. Then, too, the farmers, although they usually raise grain only, will have to begin raising some live stock to keep up the fertility of their soil and eventually to consume part of their grain.

The same thing will probably happen here that came to pass in Illinois and Iowa. Many of the grain farmers will become stock

farmers, and although they may not raise the former range cattle, they will most likely raise better ones and will finish many of them on the farms.

In some parts of the semi-arid Northwest where irrigation is not feasible and dry farming is too uncertain, the ranchman will possibly hold sway for generations to come. Here, then, will be found the man who will continue to raise cattle, and who will be interested in any phase of cattle investigations which may accrue to his benefit. The shrinkage of his cattle in transit is an item of vital interest to him because of the great distance to market, and any information which would throw light on this subject is therefore valuable. The trade from the Pacific coast is developing to such an extent that buyers are covering all of this section. If the cattleman knew approximately what his cattle would shrink in shipping to market, and knew his freight rate and other expenses incidental to shipping, he could quickly estimate from the market quotations what his cattle were worth on the farm and would be in a position to price them intelligently to prospective buyers.

There has been less complaint about shrinkage in the Northwest than in the Southwest for several reasons: The facilities for shipping are usually better, the cattle trains make faster time, and the facilities for feeding and watering the cattle at points in transit are better. The Northern Pacific road is to be especially commended for the facilities for unloading and feeding stock at their new yards at Staples, Minn. Forty cars can be "spotted" for unloading at one time, and the cattle can be very quickly unloaded and penned with feed and water before them. The manager of the yards is advised by wire of the number of cars to be fed there, and feed and water are in the pens when the cattle arrive, so there is no delay in allowing the cattle to fill. The yards are equipped with both open and covered pens, the latter to be used in case of bad weather. The pens are away from the town, where the animals can be absolutely quiet and not disturbed until reloading time. It is to be noted that cattle unloaded at this point invariably took a good fill and had a quiet rest which enabled them to stand the remainder of the journey to St. Paul or Chicago well.

The distances the cattle have to be driven to the loading pens are usually shorter than in the Southwest, and as grass is usually abundant during the shipping season they arrive at the pens in very good condition. As a rule the cattle are larger and in better flesh and are strong enough to stand up well during the long journey.

The shrinkage investigation in the Southwest described in Part I of this bulletin brought out the fact very clearly that to get accurate results on the shrinkage of cattle large numbers must be used, because there are so many factors that may influence a single shipment or

a few shipments that the results could not be taken as a general average for future consignments. Realizing that additional data were necessary to make the investigation comprehensive and complete, the work was begun in the Northwest in September, 1911, and continued there until the end of the shipping season for range cattle. It was then taken up again in the Southwest with range cattle and continued until the movement of these cattle ceased.

LESSENING THE SHRINKAGE.

Many shippers in the Northwest realize that if cattle are handled carelessly there is apt to be a heavy shrinkage, and to a certain extent they try to avoid it. This is done by using judgment in trailing the cattle to the loading pens, grazing on the way, avoiding too long a drive without resting, and giving animals some feed and water before loading. Some shippers contend that cattle should have no feed and water for four to eight hours previous to loading. Nearly all agree that an abnormal fill just before loading has a very detrimental effect upon the animals. There is a natural tendency for all cattle to lie down after feeding, and if the cattle are abnormally full when loaded they do not stand up well in the car. In these circumstances some will lie down and get trampled. A light feed of prairie hay, about two bales to each car of stock, and some water, not all they will drink, is the most desirable feed for cattle before loading. Alfalfa is not so desirable, as it has a tendency to loosen the bowels. Sometimes hay is put in the racks of cars; and if cattle have been trailed a long distance with little to eat, the hay will be relished by them and they will not be quite so restless. If they were fed just previous to loading, however, and are to be unloaded at some good feeding station, the hay in the racks is superfluous.

Some of the railroads continue to use "feed and water" cars, so that cattle will not have to be unloaded on the way to market. These, however, are unsatisfactory, for if only enough animals are put into the car so they can lie down to rest the load will be very light and the proportionate freight on each animal will be high. On the other hand, if they are loaded as are the normal stock cars the animals get very little feed and water, and can not lie down.

LARGE SHRINKAGE NOT ALWAYS AN INDICATION OF POOR TREATMENT.

The shrinkage of animals depends to a large extent upon their treatment prior to loading at the point of origin. If they have had plenty of feed and water before being loaded they will show a rather large shrinkage, whereas a shipment which has had rough treatment and no feed or water before loading may be so empty when loaded that the fill taken at market may overcome the shrinkage in transit.

Of course, in a case of this kind the shrinkage of the animals occurred on the trail, and they were in abnormal condition when first weighed.

An illustration of the above was found in two shipments of cattle originating at Dickinson, N. Dak., on October 13, 1911. One shipment of 28 head of mixed cattle were driven very slowly for 15 miles to the loading pens. They were drifted along, grazing as they went, and arrived at the loading pens with a medium fill and looking perfectly fresh, as if they had not been driven more than a mile. The other shipment of 32 head of similar cattle was rounded up and driven 20 miles without water, and held overnight and next morning without feed or water. They were very empty when loaded and certainly looked bad, showing the kind of treatment they had received. After the fill at market they were 2 pounds heavier than when weighed at the loading pens. Both shipments were sent to South St. Paul and received similar treatment after being loaded.

The treatment of these two lots of cattle had been such as to cause the shrinkage of the second shipment to take place during the drive from the ranch to the loading pens, whereas the first arrived at the pens in normal condition and consequently shrank in transit. The first shipment showed a loss in weight of 25 pounds per head but looked well at market, while the other showed a gain of 2 pounds in weight but looked very ragged. This difference in the appearance of the two lots of cattle caused a variation in price in favor of the first shipment, which far more than offset the difference in shrinkage, to say nothing of the loss on the second shipment during the trail to the loading point.

DETAILS OF WORK IN NORTHWEST.

The shrinkage of range cattle in the Northwest will first be discussed, followed by the presentation of the work done in the Southwest.

RANGE STEERS IN TRANSIT OVER 36 HOURS.

In Table 20 are presented the results of the shipment of 730 head of range steers to the Chicago market. The first three shipments of these cattle were weighed five times, namely, at the point of origin; at the feeding station before and after having feed, water and rest; on arrival at their destination; and again after receiving their fill there. A complete record was therefore secured on these cattle from the time they were loaded near the ranch until they were sold on the market.

The first three shipments in the table were steers of about the same size and quality. They were shipped under practically the same conditions and were on the road the same length of time. They were also unloaded for feed and rest at the same pens and all were treated alike. The results obtained from shipping these three lots

of steers, each of which consisted of two to five carloads, should give a fair average for this class of cattle.

These three shipments were composed of high-grade Hereford steers, 3 and 4 years old, and were in good flesh. They were good grass-fat steers, showing quality and breeding, and were very smooth for range cattle. They were drifted from the ranch to the loading pens, being herded along the way. All were in good condition when loaded. In weight they ranged from 1,225 to 1,420 pounds each at the point of origin, and were in transit 35 hours from the loading points to Staples, Minn., where they were unloaded for feed and rest. During this stage of the journey the shrinkage for each lot varied from 70 to 96 pounds per head, the average for all being 79 pounds. While at Staples they took on an average fill of 40 pounds, leaving a net shrinkage of 39 pounds per steer for the first 35 hours in transit. The fill taken by each lot was almost exactly the same.

The run from Staples to Chicago, the second stage of the journey, required 35 hours, or the same as for the first stage. The average shrinkage for the second stage was 72 pounds, as compared with 79 pounds for the first stage. The average fill taken at Chicago was 41 pounds, leaving a net shrinkage of 31 pounds per head for the second stage. The average net shrinkage for the first stage, as stated above, was 39 pounds. The fill taken by each shipment of cattle was very uniform at Chicago as well as at Staples, and the average fill at each place was practically the same, being 41 and 40 pounds, respectively. The average time in transit for the whole journey was 70 hours, and the total average net shrinkage per head was 70 pounds.

The last two shipments in the table originated on the Standing Rock Indian Reservation at Walker, S. Dak., and were shipped to Chicago. These were all high-grade Hereford steers that had been raised in Wyoming and shipped to South Dakota for grazing. All were 3 and 4 year olds of good breeding and quality. They were shipped over the Milwaukee road in "feed and water" cars. The treatment each bunch of cattle received before shipping and during transit was the same. Several days were taken in rounding them up. They were herded on good grass (Buffalo grass) until time for shipping. They were cut out the day before shipping and herded the morning of the shipping day for five hours on grass and near water, and were then cut into car lots, penned, and loaded.

The first shipment consisted of 13 carloads, or 315 head, and the second shipment of 8 cars, or 212 head. The weather was fine at time of loading and continued so until the cattle were sold. The first shipment was delayed 20 hours because of a wreck, and the cattle were consequently held in the cars for 76 hours. The second shipment made good time, being in transit but 55 hours. Each car of cattle was given 2 bales of prairie hay and some water at Montevideo, Minn.

As these cattle were fed and watered in the cars and were not unloaded, the shrinkage for the first 36 hours could not be secured. The first shipment had a net shrinkage per head of 72 pounds, and the second shipment shrank 67 pounds per head. The average shrinkage on the two shipments for the whole journey was 70 pounds.

It is of interest to note that all the five shipments in the table were shipped under the same conditions, except that the first three were unloaded for feed and water, whereas the last two were fed and watered in the cars; and the shrinkage was exactly the same in each case. The steers in the last lot from Walker, S. Dak., were a little lighter in weight and were in transit a few hours less, which would give them a little advantage over the other lot.

Notwithstanding the fact that the shrinkage by the two methods of shipping may be the same, the cattle that are rushed through on a long journey in the feed and water cars will naturally look more jaded when they reach the market, because they do not have the same chance to rest while in transit.

The first three shipments of Table 20 lost 5.5 per cent and the last two shipments 6.3 per cent of their live weight in transit to market. The average for all the steers shows a shrinkage of 5.9 per cent of their live weight.

TABLE 20.—*Range steers in transit over 36 hours.*

Number of head.	Point of origin.	Time in transit, first period.	Average weight at point of origin.	Shrinkage, first period.		Average fill, first period.	Time in transit, second period.	Shrinkage, second period.	
				Before fill.	After fill.			Before fill.	After fill.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Hours.*	*Pounds.*	*Pounds.*
115	Forsyth, Mont.	35	1,226	70	31	39	36	75	34
46	do	35	1,307	86	47	39	35	77	36
42	Glendive, Mont.	32	1,420	96	54	42	35	55	15
315	Walker, S. Dak.	.....	1,176	Fed and watered in cars.				.....	.....
212	do	.....	1,132	do.				.....	.....
	Grand average[1]	34	.....	79	39	40	.....	72	31

Number of head.	Point of origin.	Fill at market.	Total time in transit.	Total shrinkage.		Remarks.
				Before fill.	After fill.	
		Pounds.	*Hours.*	*Pounds.*	*Pounds.*	
115	Forsyth, Mont.	41	71	106	65	Drifted 18 miles in 2 days. Medium fill.
46	do	41	70	124	83	Handled same as the 115 head. These were larger and coarser steers.
42	Glendive, Mont.	40	67	109	69	Were drifted 8 miles. Fed bright hay night before and morning of shipping.
315	Walker, S. Dak.	.....	76	.....	72	Were drifted 42 miles. Grazing fine. Only medium fill.
212	do	.....	55	.....	67	Do.
	Grand average[1]	41	68	.....	70	

[1] These averages are for the first three shipments in the table, excepting total time in transit and total net shrink.

RANGE COWS IN TRANSIT OVER 36 HOURS.

The results from the shipping of three consignments of range cows from Forsyth, Mont., to Chicago are recorded in Table 21. There were 126 head of these cows, and they ranged from 942 pounds to 1,088 pounds in weight. All were high-grade Herefords.

The first two shipments were rounded up 12 days before shipping, herded for 10 days, and on the eleventh day were driven 16 miles and herded. The twelfth day they were driven 2 miles to the loading pens. They had grass, but no water, for six hours before loading. These were large cows, averaging 1,073 pounds, and were smooth, showing quality and finish. They had a medium fill when loaded and showed that they had been handled well. The shrinkage on these cattle was very uniform and in direct proportion to their weights. For the first 36 hours they shrank 41 and 43 pounds, respectively, and for the next 36 hours they shrank 26 and 29 pounds, respectively, making a total shrinkage of 67 and 72 pounds per head.

The third shipment of 51 cows was rounded up 10 days before shipping and was drifted 50 miles. These cows were not as large and not as fat as those of the other two shipments. They had grass and water until the morning of the day they were shipped and then got no more. They were loaded in the afternoon, and were rather empty. During the journey they received the same treatment as the others, being fed at Staples, but they were a little longer on the road. Their shrinkage for the first and second stages of the journey was 34 and 16 pounds, respectively, making a total of but 50 pounds per head.

The smaller shrinkage of the third shipment was primarily attributed to their poor fill at the point of origin and to their smaller size. Notice should be taken of the uniformity of fill for all shipments at both Staples and Chicago. It was practically the same at each place for each shipment.

The percentage of shrinkage to their live weights was 6.3, 6.6, and 5.3 per cent, respectively, for the three lots, with an average of 6 per cent for all. The average percentage of shrinkage for the first period of the journey (36 hours) was considerably less, namely, 3.82 per cent.

TABLE 21.—*Range cows in transit over 36 hours.*

Number of head.	Point of origin.	Time in transit, first period.	Average weight at point of origin.	Shrinkage, first period.		Average fill, first period.	Time in transit, second period.	Shrinkage, second period.	
				Before fill.	After fill.			Before fill.	After fill.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Hours.*	*Pounds.*	*Pounds.*
50	Forsyth, Mont.	35	1,066	68	41	27	36	62	26
25	do.	35	1,088	75	43	32	35	66	29
51	do.	38	942	66	34	32	37½	51	16
	Grand average.	36	1,020	68	39	29	36½	58	22

TABLE 21.—*Range cows in transit over 36 hours*—Continued.

Number of head.	Point of origin.	Fill at market.	Total time in transit.	Total shrinkage.		Remarks.
				Before fill.	After fill.	
		Pounds.	*Hours.*	*Pounds.*	*Pounds.*	
50	Forsyth, Mont	36	71	103	67	Drifted 18 miles in 2 days. Had medium fill.
25	do	37	70	110	72	Drifted 18 miles in 2 days. Coarser cows than previous shipment.
51	do	35	75½	85	50	Drifted 50 miles. Had no feed or water on shipping day.
	Grand average	36	72½	97	61	

On October 6 there was a shipment, not shown in the table, of 270 mixed range cattle from Walker, S. Dak., to Chicago. These cattle came from the Standing Rock Indian Reservation and were handled exactly the same as the shipments of steers from the same place, a record of which is found in Table 20. These were high-grade Hereford and Shorthorn steers and cows, and averaged 1,124 pounds in weight. There were 145 dehorned 3-year-old steers and 53 spayed heifers that would have classed as "choice" on the Chicago market. They showed excellent quality, far above the average, and were extremely fat for range cattle. The other 72 head were good. The whole bunch had a medium or average fill when loaded. They were shipped in feed-and-water cars and had an excellent run to Chicago, being in transit but 53 hours. Their shrinkage was 57 pounds per head, as compared with 70 pounds for the heavy steers in Table 20 and 61 pounds for the cows in Table 21.

MIXED RANGE CATTLE IN TRANSIT OVER 36 HOURS.

Table 22 presents the data secured from the shipping of mixed cattle from Glendive, Mont., to the Chicago market. All of these cattle were rounded up three days before shipping, were thrown together, and driven 40 miles in two days. They were grazed but four hours each day, and were penned the night before shipping and given hay and water. They were taken off feed at 5 a. m., were cut out and put in loading pens, and had water before them until two hours before loading, but they drank very little. No feed was given them and they were loaded at 2.30 p. m. The handling from the time they were rounded up until they were sold was exactly the same for all lots. The cattle were in transit 32 hours to Staples, Minn., took a fill there of 28 pounds each, leaving a shrinkage of but 18 pounds per head. During the second stage of the journey they were in transit 36 hours and shrank 24 pounds, of which they regained 21

pounds by fill at Chicago, leaving a net shrinkage of but 3 pounds for the second stage. The grand average net shrinkage for the whole period of 68 hours was but 21 pounds per head.

TABLE 22.—*Mixed cattle in transit over 36 hours.*

Number of head.	Point of origin.	Time in transit, first period.	Average weight at point of origin.	Shrinkage, first period.		Average fill, first period.	Time in transit, second period.	Shrinkage, second period.	
				Before fill.	After fill.			Before fill.	After fill.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Hours.*	*Pounds.*	*Pounds.*
51	Glendive, Mont.	32	833	39	10	29	38	25	4
43	do.	32	1,381	51	29	22	35	22	[1] + 6
43	do.	32	1,100	48	13	35	35	28	4
43	do.	32	993	47	21	26	35	20	11
	Grand average.	32	1,066	46	18	28	36	24	3

Number of head.	Point of origin.	Fill at market.	Total time in transit.	Total shrinkage.		Remarks.
				Before fill.	After fill.	
		Pounds.	*Hours.*	*Pounds.*	*Pounds.*	
51	Glendive, Mont.	21	70	25	14	Driven 42 miles in 2 days. Grazed 4 hours a day.
43	do.	28	67	51	23	Do.
43	do.	24	67	41	17	Do.
43	do.	9	67	41	32	Do.
	Grand average.	21	68	42	21	

[1] Gain in weight instead of a shrinkage.

There were three shipments of mixed cattle from Dickinson, N. Dak., to the St. Paul market that are not shown in the tables, as complete records on them were not secured. They should have run into St. Paul within 30 hours, but they were delayed for various reasons, in one case a drawbar pulled out, so that the cattle had to be unloaded and fed in transit. They were 41 hours in transit. The unloading took place at Staples, Minn., and the cattle were on feed 16½ hours before reloading.

One of these shipments was of 28 head of mixed cattle that had been handled carefully before loading and looked extremely well. At market they filled 22 pounds, leaving a net shrinkage of 25 pounds per head, just a little more than the average for the mixed cattle shown in Table 22.

The other two shipments received exceptional maltreatment for cattle of the Northwest. It is seldom that cattle are handled in such a manner in that section. They were rounded up one day. The following day they were driven 20 miles without either feed or water, and were then penned and held all night and until 6 p. m. the follow-

ing day without anything to eat or drink. They had neither feed nor water for 48 hours before being loaded. They naturally looked very bad, almost like shadows, when loaded, and weighed up light. There was 150 pounds of hay put in the racks of each car at Dickinson, and the cattle stayed on feed and water 16½ hours at Staples, Minn., where they took an enormous fill. The weights at Staples were not secured, as the cattle were supposed to run into St. Paul without being unloaded.

These cattle, instead of showing a shrinkage in transit weighed from 2 to 5 pounds heavier after taking a fill at market than at Dickinson, N. Dak. This was without doubt due to the abnormal condition they were in when loaded. This method of handling cattle is to be condemned, as it is cruel to the animals in the first place and unprofitable for the shipper as well. Cattle shipped under such conditions look bad when they arrive at market and show the large fill to such an extent that their selling price is much lower than for animals with an average fill. This is an instance where the large fill at market is undesirable.

DETAILS OF WORK IN SOUTHWEST.

The pastures throughout Texas had been very short during the whole year of 1910. In fact, the grass was so scant in some parts that many cattle would have died had there not been a fair crop of mesquite beans upon which to feed. Because of the drought very little grass grew along the trails over which cattle traveled to the loading pens, and the cattle driven along these trails usually arrived at the loading point with a very poor fill, and consequently weighed up light at the point of origin. Some of these cattle were so empty when first weighed that the shrinkage in transit was very small, and sometimes was completely overcome by the fill taken at the market. A season of this kind is conducive to a small shrinkage. While the results obtained from the shrinkage work of 1910–11 (shown in Part I of this bulletin) are applicable to a dry or droughty year, they do not represent the normal shrinkage under average conditions. For this reason, it was decided to duplicate the work of 1910 in the Southwest.

During the winter of 1910–11 there were frequent rains, and the grass in Texas was good the following summer. This grazing season was about a normal one for Texas, and the results obtained from the shrinkage work may be taken as an average. Most of the cattle shipped in the fall were either in good flesh or fat. There were a few exceptions, of course, but taking the cattle that were weighed as a whole, they were about the average of what go to market from Texas during a normal or average year.

Cattle from Texas may have been driven anywhere from 1 to upward of 100 miles to the railroad for shipping. As a rule they are driven from 15 to 20 miles each day and then grazed along the trail for a few hours, and this procedure is kept up until the shipping pens are reached. Few cattlemen feed their cattle on arrival at the shipping pens before loading. Many prefer not letting their cattle have any water, or if they do, to let them drink little, as it is said they do not stand up well in the cars. The racks of the cars are seldom filled with hay for the stock to eat while in transit, as some shippers claim that the cattle will eat little of it, while others assert that if the cattle do eat much hay it will diminish their hunger to such an extent that they will not take a good fill at market. However, this was found to be the case in very few instances. The discussion of this will be taken up later.

Unfortunately for the completeness of the work, in the early fall of 1911 practically the entire cattle yards of the Fort Worth Stock Yards Co. burned, destroying all the scales in the yards but one. In consequence of this the weighing of stock after sale caused such a congestion near the scales that it was impossible to weigh the range cattle on arrival at market. For this reason the fill of the animals could not be determined, but as the sale weight was secured the net shrinkage on each shipment was ascertained. As it is only the net shrinkage which is absolutely important to the cattlemen, the value of the work was not materially lessened.

RANGE COWS IN TRANSIT LESS THAN 24 HOURS.

Table 23 presents the weights and shrinkage data obtained on 1,307 range cows that were in transit to market less than 24 hours. A study of the table reveals the fact that the shrinkage varied considerably with the different lots, there being a range of 26 to 60 pounds on different shipments.

The small shrinkages invariably occurred with the cattle that had either been driven a long way to load without having sufficient time to graze along the way, or that had been held for several hours without feed or water before weighing. The cattle which showed a large shrinkage were usually ones which had taken a good fill before weighing, or had failed to fill at market, though sometimes it was due to a poor run to market. All of the shipments presented in this table received good runs to market, and the average shrinkage for all the animals, 34 pounds per head, will give a good idea of the shrinkage to be expected from shipping cattle a distance of about 325 miles, or a 22-hour run.

The shipment from Colorado, Tex., of 31 head of cows, which were in transit only 19½ hours and shrank 60 pounds, was driven but 4

miles from the pasture to the loading pens, and had a medium fill. Evidently they failed to fill at the market.

The 293 head from Colorado, Tex., forming the last item in the table, were all Mexican cows which had been on grass in Texas between 60 and 90 days. They were very poor, just frames, when brought in, and had put on flesh wonderfully fast. They were driven but 9 miles and showed a shrinkage of 46 pounds per head.

TABLE 23.—*Range cows in transit less than 24 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination after fill.	Average net shrinkage.	Remarks.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	
27	Odessa, Tex	23½	989	952	37	Had a medium fill when loaded.
28	.....do	21	868	809	59	Had grass until loaded.
520	.....do	23	987	961	26	Driven 25 miles in 2 days. Grass until loaded.
31	Colorado, Tex	19½	868	808	60	Driven 4 miles to loading pens. Had a medium fill.
202	Odessa, Tex	23	861	834	27	Trailed 25 miles to pens. Plenty of grass and water. Average fill.
61	.....do	23	879	832	47	
145	.....do	23½	876	850	26	Trailed 2 days to loading pens. Grass, but no water before loading.
293	Colorado, Tex	16½	606	560	46	Trailed 9 miles. Mexican cows grazed in Texas for 90 days.
	Grand average	22	860	826	34	

The grand average of Table 23 shows the run to be of 22 hours' duration, the average weight to be 860 pounds, and the net shrinkage to be 34 pounds. In other words, the shrinkage on cows of the Southwest for an average year was found to be 4 per cent of their live weight when they were in transit 22 hours only.

RANGE COWS IN TRANSIT OVER 24 HOURS.

In Table 24 are the weights of 17 shipments of cows, totaling 1,383, from Odessa, Tex., to the Fort Worth market. This run should be made within 24 hours, and in Table 23 are shown several shipments which made the run in less than 24 hours, but the time required for the shipments shown here varied from 24½ to 33½ hours. These cattle were chiefly grade Herefords and Shorthorns, though some were of common breeding. Practically all of them were in good condition, and some were really fat for grass cattle. The weather was good during the whole fall, though some of the days were hot. No storms or "northers" came during the time these cattle were being shipped. The animals ranged in weight from 817 to 1,002 pounds at the loading point, averaging 907 pounds. The shrinkage

on the different shipments varied greatly, ranging from 4 pounds to 64 pounds per head.

The first shipment of 25 cows was driven only 7 miles and was grazed before loading, so they had a good fill. They were in transit 28½ hours but did not have a good run. The result was that they shrank 64 pounds per head. The third shipment shrank but 4 pounds each. The fourth shipment of 80 head of cows was in transit 31 hours. These cattle had a very slow run, but still shrank only 6 pounds each. They evidently took a big fill at the market.

The shipment of 291 head of cows was driven 110 miles from the ranch to the railroad. They were on the road seven days, being trailed about 16 miles a day and grazed. However, the trip was a hard one because of its great length. The cattle were grazed the day before shipping but had neither feed nor water the day they were shipped, and as they were not loaded until 3 p. m. they looked hollow and were empty. The shrinkage on these cattle was only 16 pounds per head, which was of course due to the poor fill they had when loaded. As there are many cattle loaded in Texas under the same conditions this shipment is an important one and may be taken as an average for shrinkage on such shipments.

The difference between the shrinkage of cattle loaded under the above conditions and of cattle loaded where they have had an opportunity to graze and drink before loading is clearly shown by the comparison of this shipment with the next one below. These 27 cattle were on the road to the loading pens two days, but had grass and water until loading time. They were in transit to market 24½ hours, the same time as the 291 head, and were handled the same way after loading, but they shrank 51 pounds per head, as compared with 16 pounds for the previous shipment. The greater part of this shrinkage of 51 pounds was merely the loss of the fill taken before loading.

The last shipment shown in the table was composed of 29 cows in medium flesh. These cattle had a very poor run to market, requiring 33½ hours to make the trip. Their shrinkage was 58 pounds per head. As their fill taken at market was not secured it can not be said just how much of this large shrinkage was due to the very poor run and how much to a lack of fill at the market.

The grand averages for the 1,383 cows show their average weight to be 907 pounds, the time in transit to market to be 27 hours, and their net shrinkage to be 32 pounds per head. This is but 3.5 per cent of their live weight.

TABLE 24.—*Range cows in transit over 24 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination after fill.	Average net shrinkage.	Remarks.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	
25	Odessa, Tex.	28½	1,002	938	64	Trailed 7 miles carefully.
25	do	28½	876	836	40	
27	do	25	907	903	4	Had a poor fill when loaded.
80	do	31	910	904	6	
141	do	29	973	929	44	Trailed 2 days. Plenty of grass and water on road to pens.
50	do	24½	974	924	50	
29	do	24½	905	866	39	
255	do	24½	969	943	26	
29	do	27	885	850	35	Driven 8 miles. Had neither feed nor water before loading.
145	do	26	895	849	46	
291	do	24½	844	828	16	Driven 110 miles in 7 days to loading pens. No feed or water 20 hours before.
27	do	24½	1,001	950	51	On road 2 days. Plenty of grazing. Had medium fill.
56	do	24½	885	845	40	Driven 8 miles. Looked well and had a good fill.
27	do	25	817	774	43	Do.
60	do	33½	868	827	41	Driven 35 miles in 3 days. Had medium fill. Poor run to Fort Worth.
87	do	30½	852	808	44	Trailed 90 miles in 6 days. Medium fill.
29	do	33½	876	818	58	Had a poor run to market.
	Grand average...	27	907	875	32	

A comparison of Table 23 and Table 24 shows that the shrinkage on cows that received a normal run to market is much more uniform than for those that were delayed in transit or that just made slower time. An average of all the shipments of the cows that were from 1 to 10 hours longer in transit than an average good run from the same points shows an increased shrinkage of but 4 pounds, but the shrinkages were much more variable. In some cases, however, a large shrinkage could only be attributed to delayed transportation. The average shrinkage on 983 cattle from Odessa, Tex., in Table 23 that were in transit less than 24 hours was 28 pounds per head, while the shrinkage on those over 24 hours in transit was 32 pounds per head. The cattle were practically the same size in each case, and were handled under similar conditions.

A comparison of the shrinkage of range cows in the Southwest in transit under 36 hours can be made with the shrinkage of range cows in the Northwest for the first period of their journey, averaging 36 hours (see Table 21). In the Northwest the shrinkage for the first 36 hours was 39 pounds per head, while in the Southwest the shrinkage was 32 pounds. The shrinkage on southwestern cows for the short runs (Table 23) was 34 pounds. These results are seen to be very uniform when we consider the live weights of the

animals. Thus, the proportion of shrinkage to live weight of the southwestern cows for the short runs (average 22 hours) was 4 per cent and for the longer runs (average 27 hours) 3.5 per cent. The proportion for the northwestern cows for the first portion of their journey (36 hours) was 3.82 per cent. The grand average percentage for all is, therefore, practically the same.

MIXED RANGE CATTLE IN TRANSIT LESS THAN 24 HOURS.

Ranchmen like to cut out the cattle that are to be shipped in such manner that the different classes will not be mixed in the cars. This can not always be done, however, and animals of the various classes are sometimes indiscriminately thrown together, giving rise to mixed shipments. These consignments of mixed cattle do not always ship well, as the large ones squeeze and trample the small or the weak ones, and if the journey is very long there may be several dead or crippled animals in a car when it arrives at the market. The shrinkage on these mixed shipments of cattle may not be greater than on other classes of live stock, but because of the losses in shipping more lawsuits arise from this class of stuff than any other, and consequently the railroad companies have an aversion to it.

In Table 25 are displayed the data from shipments of mixed range cattle aggregating 849 head that were in transit less than 24 hours. All of these cattle originated from near Colorado, Tex., or Odessa, Tex. They, of course, varied in weight more than any other class of cattle, this variation depending largely upon the percentage of calves in the shipment. The average weights of the different shipments ranged from 415 pounds for a bunch of Mexican heifers to 936 pounds for a shipment of cattle from Odessa, Tex. The time in transit did not vary greatly, being 17 hours to 22½ hours.

There is a greater variation in the shrinkage for this class of animals than any other. In the table this ranged from a gain in weight of 2 pounds per head in a shipment containing 17 cows and 23 calves to a loss in weight of 71 pounds per head on another lot. The 40 cattle which averaged 2 pounds heavier at Fort Worth than they did at Colorado, Tex., were fat, but they had no feed or water before being loaded and were very empty. They took a good fill at market, which more than overcame the light shrinkage in transit.

The consignment from Colorado, Tex., of 29 cattle which shrank 71 pounds each had been pastured but 3 miles from town, and was a mixture of steers and cows. They were taken direct from the pasture to the loading pens, and were there given a feed of green kafir corn before being loaded and weighed. This gave the cattle an abnormal fill and also had a bad effect on them, as is shown by the fact that they were in transit but 21 hours and yet shrank 71 pounds per

head. An average of all the shipments of Table 25 shows a shrinkage of 26 pounds per head.

The 68 bulls from Odessa, Tex., weighed 1,124 pounds each and shrank 38 pounds per head, or 12 pounds more than the average for all the cattle. The five cars of steers, 139 head, shrank but 19 pounds each, or 7 pounds less than the average. The shipment of 40 Mexican heifers from Colorado shrank 26 pounds each. These heifers had been shipped in from Mexico 60 days previous and put on pasture. While they had gained in weight while on pasture, they were still poor when shipped.

The grand average of all the 849 head of cattle showed them to have been in transit 21 hours to market, to have had an average weight of 783 pounds, and to have lost 26 pounds in weight from shipping.

TABLE 25.—*Mixed range cattle in transit less than 24 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination after fill.	Average net shrinkage.	Remarks.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	
32	Colorado, Tex.	18	722	722	0	
47	Odessa, Tex.	23½	519	497	22	These were 14 cows and 33 calves.
84	do.	19½	950	904	46	These were 65 cows and 19 bulls.
92	Colorado, Tex.	17½	739	714	25	Driven 9 miles slowly. Had medium fill.
40	do.	17½	508	510	[1] +2	These were 17 cows and 23 calves. Poor fill at Colorado.
28	Odessa, Tex.	24	928	910	18	
28	do.	24	936	913	23	
179	do.	23½	846	820	26	Cattle were "worked" 2 days at ranch. On road 2 days to pens.
43	Colorado, Tex.	18½	521	496	25	The calves were fat, but the cows were poor and weak.
29	do.	21	886	815	71	Driven but 3 miles and fed green kafir corn before loading.
68	Odessa, Tex.	23	1,124	1,086	38	3 cars of bulls.
139	do.	19½	750	731	19	5 cars of steers.
40	Colorado, Tex.	17	415	389	26	Thin 2-year-old Mexican heifers.
	Grand average.	21	783	757	26	

[1] Gain in weight instead of a shrinkage.

MIXED RANGE CATTLE IN TRANSIT OVER 24 HOURS.

The shrinkage on mixed range cattle in transit to market over 24 hours is presented in Table 26. All of the 150 head in the table originated near Odessa, Tex., and are shipments which made poor time to market. These shipments should have gone through within 24 hours, but for various reasons were longer. The difference in shrinkage between these cattle and those from Odessa that did make the run within 24 hours may be considered due to delay, etc. Each shipment was made up of but a single car, and was made up largely

of 2-year-olds, cows, and bulls, with a few steers mixed in. There were very few calves in the shipments. The cattle were in transit from 24½ to 31 hours, and ranged from 614 to 878 pounds in weight. The shrinkage was not so variable with these cattle as with those in transit less than 24 hours.

It will be noticed that the shipment of 30 head, although the heaviest cattle, shrank the least in shipping. This is readily explained by the fact that they were started from the ranch at 3 o'clock in the afternoon and were driven 18 miles to the loading point, arriving there the next afternoon, where they were penned. They were loaded and weighed at 6 p. m., having had neither feed nor water since they left the ranch 27 hours previous. They were consequently very empty and could not shrink as much as cattle under average conditions. Then, too, they were in transit but 24½ hours and took a fairly good fill at market.

The shipment of 26 head of cattle had been held on good pasture within 6 miles of the loading pens for several days previous to shipping. They were penned at 11 a. m. and held in the pens until 5 o'clock in the afternoon without feed or water. They were then weighed, but were not loaded until 10 o'clock that night. They had a poor fill when weighed and shrank only 21 pounds after the fill at market.

On the other hand the two shipments of 28 head each had been trailed a long distance and were watered just previous to weighing. The result was a big shrinkage with each of them—75 pounds per head in one case and 55 pounds per head in the other. The latter shipment had been trailed 52 miles.

The grand average of all the shipments shows they were in transit 29 hours, their weight was 751 pounds, and their shrinkage was 42 pounds each. This is 5.6 per cent of their live weight.

TABLE 26.—*Mixed range cattle in transit over 24 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination after fill.	Average net shrinkage.	Remarks.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	
38	Odessa, Tex.	31	614	573	41	
26	do.	29	814	793	21	Driven 6 miles and held all day without feed or water.
28	do.	29	782	707	75	
30	do.	24½	878	859	19	Driven 18 miles. Had no feed or water for 26 hours before loading.
28	do.	31	711	656	55	Driven 52 miles in 4 days. Were watered before loading.
	Grand average.	29	751	709	42	

The average shrinkage per head on the mixed cattle from Odessa that were in transit less than 24 hours was 28 pounds. There were 573 head of these cattle shown in Table 25. A comparison of these with the shipments of Table 26 discloses the fact that the cattle in transit 29 hours shrank 12 pounds more than those in transit less than 24 hours. As all of them should have made the trip within the 24-hour limit, the excess shrinkage of 12 pounds per head may be attributed to the poor or slow transportation.

RANGE CALVES IN TRANSIT TO MARKET.

The shrinkage on calves has been found to be more uniform than on any other class of cattle shipped. Regardless of the weather, grazing, and other factors which seriously affect the shrinkage on large cattle, the variation in the shrinkage of calves is small. This is because the cows are always driven to the loading pens with the calves, and the calves stay with their mothers until time to cut them out to load. Their fill therefore is of milk, which is usually small in amount, and the subsequent shrinkage is likewise small. The fill at market also is not large, being but a few pounds as a rule, hence the uniformity in the results obtained.

On the 211 calves in Table 27 there is a shrinkage of 11 to 13 pounds for the different shipments. This gave an average of 12 pounds, or 4.8 per cent of their live weight. It is seen, therefore, that while the shrinkage is small it is uniform and in about the same proportion to the weight of the animals as with grown cattle.

TABLE 27.—*Range calves in transit less than 36 hours.*

Number of head.	Point of origin.	Time in transit.	Average weight at point of origin.	Average weight at destination after fill.	Average net shrinkage.	Remarks.
		Hours.	*Pounds.*	*Pounds.*	*Pounds.*	
73	Odessa, Tex.	28½	216	205	11	Driven 7 miles. Loaded without feed or water.
73	.....do.....	21	253	240	13	
65	Colorado, Tex.	19½	271	260	11	Driven 11 miles in 2 days. Stayed with cows until loaded.
	Grand average.....	23	246	234	12	

SUMMARY.

In Table 28 is presented a summary of the work of 1911. About 5,000 animals were weighed in securing these data. The grazing season of 1911 was about the average for good years, or a little better than the average when all years are considered. The results secured

are therefore a good indication of what may be expected during a normal season.

In column 1 is shown the number of shipments of each of the various classes of cattle. Column 2 shows the number of animals in each of these classes. The third column shows the average weight of the cattle at the point of origin. It is seen that the animals from the Northwest are heavier than those from the Southwest; the southwestern cows weighed from 860 to 907 pounds, while the northwestern cows averaged 1,020 pounds. The large difference between the weights of the mixed cattle from the two sections is partially due to the larger proportion of calves among the mixed cattle from the Southwest.

The burning of the cattle yards and all of the scales but one at Fort Worth prevented the cattle from being weighed on arrival from the ranch; hence their shrinkage in transit and fill at market can not be shown. The net shrinkage, however, is shown for all of the shipments.

In the fourth column is shown the variation in the gross shrinkage. This variation of shrinkage for the different shipments in each class was not great, being 18, 25, and 26 pounds, respectively, for the range steers, cows, and mixed cattle from the Northwest. The average gross shrinkage, as recorded in column 5, was 111, 97, and 42 pounds, respectively, for the same classes of cattle.

The fill taken at market was very uniform for all classes, the greatest variation being 19 pounds for the mixed cattle. The average fill for the steers, cows, and mixed cattle from the Northwest was 41, 36, and 21 pounds, respectively.

The last two columns of the table present figures for the range and the average net shrinkage for the various classes of cattle. It is of interest to note how much more uniform the shrinkage was on the different shipments of cattle from the Northwest as compared with those of the Southwest, the range of net shrinkages being quite wide with the shipments from the Southwest. The range of net shrinkage on northwestern cows was from 65 to 83 pounds, a difference of 18 pounds, while with the southwestern cows it was 26 to 60 in one case and 4 to 64 in another.

The average net shrinkage on all of the cattle was as follows: Calves, 12 pounds; northwestern range steers in transit 68 hours, 70 pounds; cows from the Southwest in transit less than 24 hours, 34 pounds, and those in transit from 24 to 36 hours, 32 pounds. The mixed cattle of the Southwest shrank 26 pounds per head when in transit less than 24 hours and 42 pounds when in transit from 24 to 36 hours, while the mixed cattle of the Northwest shrank but 21 pounds per head while in transit for about 72 hours.

TABLE 28.—*Summary of northwestern and southwestern work of 1911.*

Description.	Number of shipments.	Number of cattle.	Average weight at origin.	Gross shrinkage.		Fill at market.		Net shrinkage.		Ratio of shrinkage to live weight at origin.
				Range.	Average.	Range.	Average.	Range.	Average.	
			Pounds.	*Pounds.*	*Lbs.*	*Pounds.*	*Lbs.*	*Pounds.*	*Lbs.*	*Per ct.*
Southwestern range calves en route less than 36 hours.	3	211	246	.....	.....	.....	.....	11–13	12	4.9
Northwestern range steers en route over 36 hours.....	5	730	1,193	106–124	111	40–41	41	65–83	70	6.0
Southwestern range cows en route less than 24 hours...	8	1,307	860	.....	.....	.....	.....	26–60	34	4.0
Southwestern range cows en route 24 to 36 hours	17	1,383	907	.....	.....	.....	.....	4–64	32	3.6
Northwestern range cows en route over 36 hours.....	3	126	1,020	85–110	97	35–37	36	50–72	61	6.0
Southwestern mixed range cattle en route less than 24 hours.....	13	849	783	.....	.....	.....	.....	+2[1]–71	26	3.3
Southwestern mixed range cattle en route 24 to 36 hours.	5	150	751	.....	.....	.....	.....	19–75	42	5.6
Northwestern mixed range cattle en route over 36 hours.....	4	180	1,066	25–51	42	9–28	21	14–32	21	2.0

[1] Gain in weight instead of a shrinkage.

CONCLUSIONS.

1. A big shrinkage may be caused by one of three things, viz., (*a*) A big fill at the point of origin when weighed; (*b*) failure to fill at destination; or (*c*) a poor, slow run to market.

2. The shrinkage for the first 24 hours is always greater than for any succeeding period of the same length, and the rate of shrinkage is also much greater for the first 24-hour period than for any succeeding period.

3. Cattle of the Northwest will shrink from 5 to 6 per cent of their live weight while in transit from 36 to 72 hours.

4. There is practically no difference in the rate of shrinkage of spayed heifers and steers of the same size and quality when shipped under similar conditions.

5. The shrinkage of cattle from Montana and the Dakotas to the Chicago market was not as great as usually predicted by the cattlemen of that section.

6. The careful handling of cattle while driving to the loading pens, and the feeding of some good bright hay just before loading is profitable for the shipper.

7. Too great a fill of water just previous to loading should be avoided, the condition of the cattle should approach the normal as near as possible when ready to ship.

8. The practice of holding cattle off feed and water for a long period before shipping with the idea that they will take an exceed-

ingly large fill at market is a poor policy, as it is neither profitable nor humane.

9. The shrinkage is more uniform with calves than with any other class of animals. Their shrinkage, however, maintains about the same ratio to their live weight as does the shrinkage on grown animals shipped the same distance.

10. There was a smaller percentage of calves shipped from the ranges of the Northwest than from the Southwest.

11. An average for all of the shipments shows that during the second period of 36 hours in transit the cattle shrank about 40 per cent less than they did during the first 36-hour period.

IV. SUMMARY OF THREE YEARS' SHRINKAGE WORK.

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GENERAL STATEMENT.

The cattle used in making this investigation were raised in different parts of the West. The range cattle work was carried on in the various Western States from Texas to Montana, and the work with the fed cattle was confined chiefly to the States of the Middle West. No discrimination was made against any section, but the work was done where the conditions were most favorable for it. There were many things that had to be considered, but the one of most importance was the scales used in making the weighings. There were no platform scales that could be used in weighing cattle on the hoof in the range country, so the railroad track scales had to be used. Great care was taken in making all weighings that the data should be accurate. The officials of the railroads realized the importance of the work and gave whatever aid was asked of them. The Texas and Pacific road even went so far as to purchase scales for weighing cattle on the hoof and placed them in the alleys of two of their important loading pens, so that all cattle would have to pass over them before being loaded. These scales were large, being 14 by 42 feet, so that a whole car of cattle could get on them at one time without crowding. They were set on a solid concrete foundation and were very accurate. The installation of these scales at Colorado, Tex., and Odessa, Tex., aided very materially in securing the shrinkage data on cattle from the Southwest. The burning of the cattle yards at Fort Worth in 1911 prevented the weights of cattle being taken on arrival, so the fill the animals took at market could not be ascertained for that year.

The shrinkage of cattle in transit is such a variable factor that no one can say definitely how much it will be during a journey, but by the use of very large numbers of cattle an average shrinkage will be obtained which may be used as a basis for estimating the amount of shrinkage on cattle shipped under similar conditions.

The figures for any class of cattle of the Southwest will be seen to vary widely for the years of 1910 and 1911 because of the great dissimilarity in the two seasons, which caused a difference in the grazing, the fatness of the animals, scarcity of water, etc. If the figures

of this bulletin are used, care should be taken to look up the results for shipments of cattle that were made under conditions similar to the ones which are to be used for comparison. The results shown in Part I are typical of a very droughty year in the Southwest, and therefore could not be used in estimating the shrinkage of cattle shipped from Texas during a good grazing season. The figures shown in Part III should be used for such. Nor would they be applicable for estimating a shrinkage on cattle in the Northwest.

The range cattle of the Southwest principally came from Texas, although there were some from Arizona and Mexico. From the Northwest the range cattle came chiefly from the Dakotas, Montana, Wyoming, and Nebraska. It is interesting to note that in the work of the Northwest there is not a shipment of calves recorded, while they were quite common in the Southwest. Texas has built up a reputation for calves as feeders and stock cattle, while in the Northwest they are kept on the range until they are 2 to 4 years old. The northwestern cattle are heavier, usually fatter and shrink more per head in shipping than do Texas cattle, but when the length of the journey to market is considered there is very little difference in the shrinkage.

When care is used in trailing the cattle to the loading pens, not driving them too fast nor too far in a day and giving them five or six hours a day to graze on the way, long distances may be covered with no apparent injury to the cattle. On arrival at the pens it is well to give the animals a light feed of hay with a little water, or allow them to graze a short time before loading them, unless the grass is very luxuriant. An excessive fill of water or green fodder or grass just before loading is not good for the cattle, as it may cause them to scour in transit; then, too, they will not stand up as well in the cars. The scouring may affect the intestinal tract to such an extent that the cattle will not take a good fill at the market.

All of the corn-fed cattle were finished during the winter or early spring months. While none of them had to be driven long distances to the loading pens, the roads were often in such bad condition because of snow and ice as to make the trip laborious and hard on the cattle. The cattle were usually fed and watered a short time before loading, and many times hay was put in the racks of the cars. The treatment they received in this respect was far better than that which was accorded to the range cattle. There is no doubt that the feed given the cattle before loading increased the shrinkage in transit, but that does not mean that it was not beneficial to the cattle and profitable to the shipper, because the cattle would naturally look better for having been handled this way, and they would sell at the market at a price which would more than offset the increased shrinkage. More care is always taken by the feeder than by the ranchman in

preparing cattle for shipping. This is natural, for conditions are such that it is much easier for him to do this; then, too, his stock is more valuable per pound than grass cattle, and the increased shrinkage on them entails a greater financial loss.

The feeders of beet-pulp cattle have made a closer study of the shrinkage of their stock than any other class of feeders. This is probably because the operators of sugar mills feed large numbers of cattle and can therefore be better equipped to do the weighing. It must be conceded, however, that usually they are more progressive than the average farmer or stockman. The cattle fed on beet pulp were always taken off the pulp ration about 24 hours previous to shipping and put on a dry ration of hay and grain. This always caused a shrinkage in weight, varying from a small amount to as high as 68 pounds per head. This shrinkage for the day before shipping naturally decreased the shrinkage which the cattle would undergo while in the cars. Even then, however, the shrinkage in transit on the pulp cattle was always large.

Feeders who finish their cattle on silage follow practically the same plan in regard to giving the cattle dry hay or fodder for the 24 hours preceding shipment. It is not uncommon, also, for the water to be cut off from the silage-fed cattle for about 12 hours before loading. This naturally causes the cattle to undergo a shrinkage just previous to shipping and thus favors a smaller shrinkage in transit.

Table 29 follows, showing a general summary of all the shrinkage work recorded in this bulletin.

TABLE 29.—*General summary of three years' shrinkage work.*

Class.	Number of shipments.	Number of cattle.	Average weight at origin.	Gross shrinkage.		Fill at market.		Net shrinkage.		Ratio of shrinkage to live weight at origin.
				Range.	Average.	Range.	Average.	Range.	Average.	
			Lbs.	*Pounds.*	*Lbs.*	*Pounds.*	*Lbs.*	*Pounds.*	*Lbs.*	*Per ct.*
Range steers in transit less than 36 hours	2	197	794					19- 55	29	3.65
Range steers in transit 36 to 72 hours	8	882	1,186	57-124	89	13-41	25	26- 83	64	5.40
Range steers in transit over 72 hours	2	169	1,116	85- 99	88	2-36	27	49- 97	61	5.47
Range cows in transit less than 24 hours	15	1,724	838	33-105	60	5-88	30	[1] +12- 60	30	3.58
Range cows in transit 24 to 36 hours	21	1,551	896	38-129	70	9-70	39	[1] + 5- 64	31	3.46
Range cows in transit 36 to 72 hours	4	275	1,034	90-110	96	36-56	46	34- 72	50	4.84
Range cows in transit over 72 hours	3	177	1,010	49- 85	70	28-35	30	21- 56	40	3.96
Mixed range cattle in transit less than 24 hours	21	1,511	700	19- 84	37	1-56	22	[1] +12- 71	15	2.14
Mixed range cattle in transit 24 to 36 hours	17	872	848	27-118	72	[2] −8-55	18	19-114	54	6.37

[1] The plus sign (+) indicates a gain in weight instead of a shrinkage. Attention is called to the 16 shipments of range calves, wherein the ratio of shrinkage to live weight (last column of table) is unduly low, because the great majority (13) of the shipments occurred in 1910, the droughty year. The 3 shipments in 1911, the normal year, gave a ratio of 4.9 per cent.

[2] The minus sign (−) indicates a loss in weight instead of a fill.

TABLE 29.—*General summary of three years' shrinkage work*—Continued.

Class.	Number of shipments.	Number of cattle.	Average weight at origin.	Gross shrinkage.		Fill at market.		Net shrinkage.		Ratio of shrinkage to weight at origin.
				Range.	Average.	Range.	Average.	Range.	Average.	
			Lbs.	*Pounds.*	*Lbs.*	*Pounds.*	*Lbs.*	*Pounds.*	*Lbs.*	*Per ct.*
Mixed range cattle in transit 36 to 72 hours.	10	622	954	25–110	76	9–47	39	[1]+ 1– 51	37	3.88
Mixed range cattle in transit over 72 hours..	6	988	729	42– 96	80	16–40	29	7– 71	51	7.00
Range calves in transit less than 24 hours....	8	773	185	[1]+[2] 1– 17	[2] 6	[2] 6–13	[2] 7	[1]+14– 13	[1]+ 1	[1]+ .59
Range calves in transit over 24 hours.....	8	772	193	[3] 6– 11	[3] 6	[4]—[3] 3–17	[3] 11	[1]+ 9– 13	[1]+ 5	[1]+2.45
Mixed corn-fed cattle in transit less than 24 hours.....	4	164	1,303	59– 95	67	4–48	16	20– 64	51	3.91
Mixed corn-fed cattle in transit 24 to 36 hours.....	59	1,853	1,167	47–128	85	19–52	37	18– 88	48	4.11
Mixed silage-fed cattle in transit less than 24 hours.....	14	666	1,168	46–128	76	6–97	52	[1]+ 7– 67	24	2.05
Mixed silage-fed cattle in transit 24 to 36 hours.....	4	169	1,204	84–121	101	50–64	58	27– 75	43	3.57
Cottonseed-meal-fed steers in transit 30 to 48 hours.....	10	1,296	1,074	61– 76	72	9–21	14	41– 73	58	5.40
Beet-pulp-fed cattle in transit 60 to 120 hours.	10	1,009	1,390	90–111	100	11–26	25	16– 99	75	5.40
Beet-pulp-fed cattle in transit 38 to 120 hours.	32	2,614	.....	.....	.....	.....	.....	[1]+ 5–132	54	.....

[1] The plus sign (+) indicates a gain in weight instead of shrinkage. Attention is called to the 16 shipments of range calves, wherein the ratio of shrinkage to live weight (last column of table) is unduly low, because the great majority (13) of the shipments occurred in 1910, the droughty year. The 3 shipments in 1911, the normal year, gave a ratio of 4.9 per cent.

[2] Data on 635 head.

[3] Data on 699 head.

[4] The minus (—) indicates a loss in weight instead of a fill.

NOTE.—The data were incomplete on the shipments where blank spaces are found. The cattle mentioned in the text but not included in the tables are not shown in this table, nor are the 7 shipments of 1,310 cattle presented in Table 5.

CONCLUSIONS.

There is no way of entirely preventing shrinkage in the shipping of cattle, but by judicious care in handling and feeding the cattle just previous to shipping the shrinkage may be lessened. If cattle are to be in transit for 24 hours or longer it is a good plan to feed about two bales of nice bright hay for each carload a few hours before loading.

The reader should understand that the three tests in this bulletin are not directly comparable, but they do in a general way give a good idea of what will occur in shipping cattle under various conditions. The difference in the shrinkage of the cattle of Parts I and III was chiefly due to the season and factors which are influenced by it. During the season of 1910 most of the shrinkage of the cattle occurred during the drive to the loading pens, because there was little grass and water to be secured along the trails and the cattle were so empty when shipped that the shrinkage was small, and the fill taken at market oftentimes overcame it.

When the distance to market is considered, the shrinkage on the cattle from the northwestern ranges was about the same as the shrinkage of Texas cattle during a normal year. The grazing season of 1911 was a normal one over the entire West, so the shrinkages of range cattle for that year are directly comparable.

In Part III the shrinkage on cattle from the Southwest was 34 pounds for cows in transit less than 24 hours; 32 pounds for cows in transit from 24 to 36 hours, and 26 to 42 pounds for mixed cattle in transit for the same periods; while in the Northwest the shrinkage for the first 36-hour period was 39 pounds for cows, 39 pounds for steers, and 18 pounds for mixed cattle. In other words the shrinkage in the Southwest was 3.5 per cent of the live weight for cows and 3.7 per cent for mixed cattle, while in the Northwest the percentage was about 3.3 for an average of all the cattle for the first 36 hours en route.

In Part II the shrinkage for mixed range cattle in transit over 72 hours is seen to be 53 pounds per head, or 5.1 per cent of their live weight, while in Part III the shrinkage on range cattle in transit for the same length of time is 70 pounds for steers, 61 pounds for cows, and 21 for mixed cattle, or an average of 60 pounds per head when all are considered. The range cattle used in Part II were shipped from Wyoming and Montana, while those recorded in Part III were from Montana and the Dakotas. The shrinkage on the latter cattle was 5.9 per cent for the cows and 6 per cent for the steers, which was a little greater than for the cattle recorded in Part II. When all of the cattle from the Northwest are considered which were in transit over 70 hours, the shrinkage ranged from 3.96 to 7 per cent, or an average of about 5½ per cent of their live weight. The shrinkage of all the cattle from the sand hills of Nebraska was about 5.2 per cent of their live weight.

In Part II is shown the shrinkage data on pulp-fed and silage-fed cattle. The pulp-fed cattle shrank very materially when they were put on dry feeds for 24 hours just previous to shipping. In one case this shrinkage was 32 pounds and in another case 68 pounds per head. Despite these large losses in weight just previous to loading, the shrinkage in transit and the net shrinkage at market were greater per head than for any other class of cattle. They did not take as large a fill as might have been expected. The net shrinkage on the pulp-fed cattle was 5.4 per cent of their live weight.

Some very interesting data are found in the table on pulp feeding in Part II. It is shown that the shrinkage on the pulp-fed cattle increased with the length of the journey. The distances and time of shipments in transit from the Colorado feed lots to market were about as follows: To St. Joseph, 520 miles or 57 hours; Kansas City, 580

miles or 60 hours; St. Louis, 825 miles or 70 hours; and Chicago, 1,000 miles or 119 hours. The average shrinkage of all cattle to St. Joseph was 37 pounds; to Kansas City, 55½ pounds; to St. Louis, 68 pounds; and to Chicago, 88½ pounds.

The silage-fed cattle were usually put on dry feed the day before shipping, and no doubt there was considerable shrinkage on these cattle during this time, although there are no data to confirm this. This would be especially noticeable where the water was cut off from them for 12 hours before shipping, as was sometimes done. All of the silage-fed cattle shrank heavily in transit, but in every case took a large fill at market. The fills taken were so large that the net shrinkage on silage-fed cattle averaged smaller than for any other class of fed cattle.

There was one shipment of 107 head of silage-fed cattle which were held off water but given dry feeds for over 15 hours before shipping, and consequently shrank so little in transit that the fill taken at market overcame the shrinkage and they showed a gain of 7 pounds each. This lowered the shrinkage on the whole class several pounds. The shrinkage on the silage-fed cattle was 29 pounds for those in transit less than 24 hours and 43 pounds for those in transit from 24 to 36 hours. This was equivalent to 2.05 per cent of the live weight in one case and 3.57 per cent in the other.

A glance at Table 29, presenting the general summary of the work, brings out the fact that the weights of about 2,500 head of corn-fed cattle were used in determining the shrinkage on this class. The gross shrinkage is seen to vary widely, ranging from 47 to 128 pounds per head. The fill taken at market varied from 4 to 52 pounds per head. The average fill at market was smaller than for any other class of grown cattle except those fed on cottonseed meal and hulls. The net shrinkage of these cattle was 51 pounds for the steers which were in transit less than 24 hours, and 48 pounds for lighter steers which were in transit from 24 to 36 hours. This was a heavier shrinkage than that of the range cattle for the same length of time, but when the weight of the animals is considered the percentage of shrinkage is seen to be about the same, the corn-fed steers in transit less than 24 hours shrinking 3.91 per cent as compared with 4.11 per cent for the steers in transit from 24 to 36 hours. This shrinkage was greater than that of the silage-fed steers, but much smaller than for the pulp-fed cattle.

The cattle fed on cottonseed hulls and meal shrank very uniformly, and the gross shrinkage was not large: it was, in fact, not as large as that of either pulp or silage fed cattle. However, all of these cattle arrived at market when snow and ice were everywhere in evidence, and the fill taken in every case was small, so that the net shrinkage was comparatively high.

Cattle shipped in "feed and water" cars do not seem to shrink any more than cattle handled by the common method of unloading to feed in transit, but they do not look as well at market, since they oftentimes have a drawn appearance. This is only natural, as these cars are usually loaded the same as ordinary cars, and the cattle can not lie down to rest.

The shrinkage in transit may be increased by sudden changes of temperature, or by cold rains or snow.

The fill at market varies greatly with different cattle, or with various shipments of the same class of cattle when weather conditions are not the same. The fill depends to a large extent upon the time of arrival. If cattle arrive about four to six hours before they are offered for sale they will usually take a good fill. They may take a good fill, however, and then be held until so late in the day before being sold that they will lose most of it. This is especially true with range cattle, as they are usually nervous and do not eat much in the daytime, while crowds of people are about.

Cattle that arrive the afternoon before being sold usually take a good fill if the weather is favorable and they are given the same kind of feed to which they have been accustomed.

When cattle have undergone a long journey to market requiring from 60 to 100 hours, the character of the accommodations at the unloading station was found to affect the shrinkage of the animals. Where the pens were sheltered, well drained, and located in a quiet place the cattle took a nice fill and a good rest, and the shrinkage was smaller than when they were unloaded under less favorable conditions.

SUMMARY OF CONCLUSIONS.

The three years' work may be briefly summarized as follows:

1. The shrinkage of cattle in transit depends very materially upon:

(*a*) The conditions existing at the time of shipping and upon the treatment received during the drive to the loading pens.

(*b*) The length of time the cattle were held without feed and water before being loaded.

(*c*) The nature of the fill which the cattle had before loading. If it was of succulent grass, beet pulp, or silage, a great loss in weight was experienced.

(*d*) The weather conditions at the time of loading and while in transit.

(*e*) The character of the run to market. Slow, rough runs naturally caused a greater shrinkage.

(*f*) The kind of treatment they received at unloading stations.

(*g*) The time of arrival at market. If they arrived just before being sold, the fill was small. Cattle that were shipped a long dis-

tance and arrived at market during the night usually did not fill well. If they arrived the afternoon before or about daylight of the sale day, they generally took a good fill.

(*h*) The climatic conditions at the market.

2. An exceedingly large fill at market is not desired, as it will detract from the selling price.

3. The shrinkage on calves may seem small, but under normal conditions it holds about the same proportion to their weight as is found with grown cattle.

4. The difference between the shrinkage of cows and steers is not as great as is ordinarily supposed. Steers will usually shrink somewhat less than cows of the same weight.

5. The shrinkage during the first 24 hours is greater proportionately than for any succeeding period of the same duration.

6. The shrinkage of cattle was found to vary in direct proportion to their live weight when conditions were the same and all other factors were equal.

7. The shrinkage of range cattle in transit over 70 hours during a normal year is from 5 to 6 per cent of their live weight. If they are in transit 36 hours or less the shrinkage will range from 3 to 4 per cent of their live weight.

8. The shrinkage of fed cattle does not differ greatly from that of range cattle for equal periods of time. It varied from about 3 per cent with all of the silage-fed cattle and 4.2 per cent with the corn-fed cattle, when both classes of these animals were in transit for less than 36 hours, to 5.4 per cent for the pulp-fed cattle which were in transit from 60 to 120 hours.

9. Cattle fed on silage have a large gross shrinkage but usually fill so well at market that the net shrinkage is small.

10. Pulp-fed cattle shrink more in transit than any other class of cattle, and also present a greater net shrinkage.

11. The shrinkage on cattle is proportionately smaller for each 12 hours they are in transit after the first 24-hour period is passed. This is shown very clearly in Table 29, which presents a general summary of the work.

12. For a long journey the common method of unloading for feed, water, and rest is to be preferred to the use of "feed and water" cars.

13. Cattle should be weighed before being loaded wherever practicable, since a comparison of this weight with the sale weight will show the net shrinkage. Moreover this weight at point of origin may be of material benefit to the shipper in case of a wreck or a very poor run to market.

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